

## HORTICULTURAL ABSTRACTS.

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**Abstracts.** Initialled abstracts in the present number are by N. Esbjerg, Director of Blangsted Experiment Station, Odense, Denmark, A. M. Massee, W. S. Rogers and H. Wormald.

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# Horticultural Abstracts

Vol. VII

September, 1937

No. 3

## HORTICULTURE—MISCELLANEOUS.

524. COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH.

63(071)

**C.S.I.R. Ten years of progress 1926-36.***Publ. Coun. sci. industr. Res. Aust.,* 1936, pp. 67.

The organization of the C.S.I.R. and its manifold activities and achievements during the first ten years of its existence are reviewed. The ground covered ranges from agriculture and forestry to mining investigations and radio research. Among fruit crops the apple has received, and is receiving, particular attention. Investigations are in progress on rootstocks, biennial bearing and on the factors responsible for the physiological disorders which develop in the fruit during storage and transport. Among the problems associated with these disorders, that of bitter pit has been cleared up satisfactorily. The trouble has been shown to develop in fruit which has been picked at too early a stage of maturity, and, to assist in determining the correct stage of maturity, a simple iodine test has been evolved and a colour chart prepared. Cold storage investigations on citrus fruits and plums, and cold and gas storage investigations on apples and peaches are in progress. The experiments have brought to light one very important point, namely that the keeping quality and storage life of certain types of fruit, such as citrus, vary to a marked extent according to the localities in which they are grown. Investigations on the packing, transport, and ripening of bananas have also yielded valuable results.

525. HARDER, R. AND VON DENFFER, D.

612.014.44

Lichtintensität und Photoperiodismus. (**Light intensity and photoperiodicity.**)*Züchter,* 1937, 9 : 41-6, bibl. 6.

Early investigations at Göttingen\* had shown that moonlight influences the growth of long and short day plants differently. Long day plants exposed to the full effects of moonlight came into flower 1-2 days earlier than those screened from it, while short day plants exposed to its effects flowered 1 or 2 days later than those not exposed. The authors describe experiments with two long day plants, *Sinapis alba* and *Agrostemma Githago*, and one short day plant, *Setaria italicica*, which were submitted to different intensities of light during their growth period. They summarize as follows:—"Plants which react to light are the more strongly influenced by changes in light conditions, the more these differ from the optimum conditions. Long day plants grown under short day conditions are very strongly affected by additional light of even minimum intensity during the period in which they are deprived of their optimum light conditions; even less than 0·25 Lux may result in advancing the flowering period by 2 weeks. High intensities of additional light have on the contrary very little effect; decreasing the natural light even as much as 80% has practically no effect. In short day plants, on the other hand, artificial lighting results in appreciable delay of flowering only when the lighting given is relatively intense; the intensities which were actually most effective in the case of long day plants had practically no effect on short day plants. The sensitiveness to artificial lighting differs greatly according to the intensity of the normal daylight in which the plants are growing. Individual species of the same photoperiodic types behave differently. Winter conditions are entirely different to summer conditions."

\* Gaertner, T., *Beih. bot. Zbl. A.*, 1935, 53 : 554.

526. SINGH, B. N. AND MITRA, G. P. 631.415 : 581.14

**Plant-growth in relation to hydrogen-ion changes in its medium.**

*Indian J. agric. Sci.*, 1937, 7 : 327-48, bibl. 38.

The growth behaviour of a number of crop plants of varying constitutions was studied under controlled laboratory conditions in culture-solutions of different hydrogen-ion concentration. The response of plants is correlated with (1) the degree of buffering of their saps and (2) the resulting acidity of the medium, and an attempt is being made to determine a suitable range necessary for obtaining maximum growth. Parallel studies were made as to the hydrogen-ion drifts occurring in soil cultures in relation to crops growing on them. The data are statistically treated. The following conclusions are drawn. Plants usually alter the pH of the growing medium, the capacity for doing so varying with different plants. The phenomenon is explainable by the analogy observed between the changed H-ions and the buffering properties of cell-sap. The growth of the plants depends to a large extent upon the "final" hydrogen-ion concentration of the medium. Every plant has an adjustable specific range of the initial pH, below and beyond which the plant fails to grow normally. Short stubby branched root systems are generally associated with higher concentrations of hydroxyl ions. The optimal pH requirement of plants for obtaining maximum growth differs with different species as also with varieties, the range varying according to their biochemic constitutions. It is recommended that the optimal pH requirements of plants should be studied before undertaking an artificial adjustment of the soil. [From authors' summary.]

527. SINCLAIR, K. J. 631.841.7

**A short review of experimental work on the manurial value of synthetic urea.**

*Emp. J. exp. Agric.*, 1937, 5 : 162-8.

Information on field experiments and demonstrations with urea in the British Isles, Australia, U.S.A. and other countries is summarized. The evidence shows that urea is comparable in effectiveness with ammonium sulphate and ammonium chloride on crops of temperate regions; in Java and Natal on sugar cane, however, urea was less effective than ammonium sulphate.

528. V. D. MUYZENBERG, E. W. B. AND VAN RIJN, J. J. F. R. 631.462 : 631.588.1

De grondontsmetting door middel van electriciteit. (**Electric disinfection of soil.**) [English summary 1 p.]

*Meded. Lab. Tuinbouwpl. Wageningen*, 25, 1937, pp. 74, bibl. 43, being reprinted from *Meded. LandbHoogesch. Wageningen*, Deel 40, verh. 4.

Electrical methods of soil disinfection are described in detail and the literature published on the changes in the soil induced by such treatment is summarized. The effects on plant growth are discussed. The J. van Groen and W. G. v. d. Kroft resistance heater system is described in detail. The influence of moisture, of quantity of electrolytes and of compression of soil on soil conductivity is considered. A formula is given to express the relation between temperature and conductivity of the soil. The relation between strength of current and temperature during the whole process as observed in experiments with river sand and with clay soil is discussed and graphed.

529. HUTCHINSON, H. P. 634.973.623

**The effects of the removal and retention of lateral branches in the production of sets of the cricket bat willow.**

*Annu. Rep. Long Ashton Res. Sta. for 1936*, 1937, pp. 231-4, bibl. 1.

Results to date suggest that a compromise might give the best results. Further experimental work to determine this point would involve partial reduction of shoots either (1) by cutting a number out completely, (2) by disbudding a number early in the year, or (3) by cutting back the laterals in the summer, leaving a sufficient length for secondary laterals to develop from them. [From author's summary.]

530. HUTCHINSON, H. P. 634.973.623  
Dormant roots and buds of the cricket bat willow—*Salix caerulea*—and their effects on the wood.

*Annu. Rep. Long Ashton Res. Sta. for 1936, 1937, pp. 235-8, bibl. 1.*

A study of the growth of root initials and bud knots in the willow show very clearly that dormant buds seem to arise from the existing bud tissue only and that dormant roots similarly arise from pre-existing primitive root tissue, but they may be induced to form a callus in *S. caprea*, *S. alba* and probably other species.

### TREE FRUITS, DECIDUOUS.

#### General.

531. CAMBRIDGE COUNTY AGRICULTURAL EDUCATION COMMITTEE. 634.1/7 : 581.084.2

**The Rampton Fruit Demonstration Station, 1929-1936.**

*Publ. Cambridge agric. Education Cttee, 1936, pp. 34.*

The Rampton Fruit Demonstration Station was established in 1929 with a view to testing promising stocks and varieties of fruit and methods of pruning, spraying and pest control under the heavy, but well-drained soil conditions existing in the area. The present paper describes the results of observations made up to the end of the 1936 harvest. The behaviour is recorded of 15 varieties of apple on the better-known East Malling rootstocks, of 6 varieties of pear on Quince A, of 6 varieties of plum on several stocks, and of a number of gooseberries, raspberries, red and black currants and strawberries. Although observations will have to be continued for a further period of years before very extensive conclusions can be drawn, the data collected up to the present have already provided some interesting information as to which stocks and varieties are clearly unsuitable for the area.

532. PHILP, G. L. AND DAVIS, L. D. 634.25 + 634.26  
**Peach and nectarine growing in California.**

*Circ. Calif. agric. Ext. Serv. 98,\* 1936, pp. 62, bibl. in text.*

Almost every aspect of peach and nectarine growing in California would appear to receive attention in this circular. The contents of the principal sections are as follows:—Choice of locality in relation to climate, water supply, soil and transport and marketing facilities; varieties for canning, drying and sale as fresh fruit, with notes on times and sequence of ripening and descriptions of the more important sorts; propagation, including the raising of seed, budding, top-working and rootstocks; the establishment of an orchard, installation of an irrigation system and planting; training and pruning; cultural practices including cultivation, intercropping, covercropping, manuring, frost protection, fruit thinning and irrigation; the control of parasitic diseases; the control of the non-parasitic diseases, little-leaf, gumming and split-pit; the control of insect pests; a spraying programme; costs of growing peaches; harvesting, packing, and handling for drying and canning; and, finally, a separate section on the varieties, harvesting and handling of nectarines.

533. CARRIER, M. C. 634.63  
**L'olivier en Tunisie. (The olive in Tunisia.)**  
*Tunisie agric., 1937, 38 : 64-70.*

The paper consists of an address delivered in February, 1937, to the conference of the Société des Agriculteurs de la Tunisie. It is mainly concerned with the advisability of extending the cultivation of olives from South Tunisia to North Tunisia. It is suggested that wherever the rainfall is below 400 mm. olives should be planted as being one of the few paying crops likely to thrive. With a rainfall above 400 mm. other crops may be grown and the olive becomes less

\* Supersedes *Circ. 42, 1930, Peach culture in California*, by E. L. Overholser and W. P. Duruz.

important. Nevertheless, olive planting is not to be embarked on in the expectation of a quick return. Fifteen years in the North and 20 years in the South may elapse before a newly planted grove becomes self supporting.

534.

AMIABLE, —.

634.63

Pratique culturelle de l'olivier en Tunisie et fonctionnement du Service de la Ghaba du Nord. (**Methods of olive cultivation in Tunisia and the work of the Service de la Ghaba.**)

*Tunisie agric., 1937, 38 : 71-118.*

The various types of soil available for olive growing in Tunisia are discussed. The best aspects are south slopes, which provide shelter from the damaging north and north-west winds. The need for measures against erosion is pointed out. The most suitable types of olive are described. The use of cuttings should be preferred to any other type of propagation for reasons discussed in the paper, though grafting can be used in top-working and is described. Care should be taken not to plant the cuttings too deep, this being a cause of many failures, particularly in clay soils. They should, however, be completely covered to a depth of 5 cm. In most cases losses will be from 10-40%. Some cuttings take 18 months to shoot. Spacing in plantations should be not less than  $10 \times 10$  metres and should be wider in light soils. Planting holes should be prepared the previous summer and allowed to air. Except on sandy soils the hole should be 1 metre cube and in its preparation the use of explosives may be necessary either to make the hole at all, or, if dug, to break up the hard pan at the bottom. In any case the thorough breaking up of the subsoil in the hole by one means or another is advocated. In transplanting from the nursery a ball of soil should be left on the roots if possible, and the foliage partly cut back. The plant is set on a mound within the hole, the roots being spread well out. Planting is deeper in the drier districts. Year-old plants show fewest transplanting losses, but even then a dry planting season may result in 75% of losses ; for this reason alone the author prefers to plant unrooted cuttings in their permanent positions. V shaped furrows, their open ends lying up the slope and their apices on the tree holes, which are kept slightly hollowed, should be carefully maintained. Clean weeding is advised. The local custom of root pruning to force the production of an increased number of feeding roots is risky, particularly if the succeeding season is a dry one. Cultivation should be to a depth of 18-20 cm. to encourage deep rooting. Five tillings are given annually. An annual bark scraping of older trees to remove insects and moss is a custom that is falling into disuse. Pasturage in the olive groves should be totally, and not only seasonally as now, prohibited by law because of the damage to the trees. The use of the Arab plough should be discontinued in favour of the more efficient vineyard plough. Experiment has shown that the added cost will be amply repaid by increased yields. It is almost impossible to induce local cultivators to employ a rational method of pruning. They cling to the local customs of antiquity. These vary with the district and four are described. The theory of pruning in general is discussed at length. The arguments are then applied to the olive and a general system outlined which must, however, be adjusted to the needs of the tree. It makes use of the ordinary methods of maintaining the balance of the tree such as elimination of dead, weak or ill-placed branches, and the thinning of the fruiting twigs to a handsbreadth. Instructions are also given as to the best pruning methods to effect a rapid restoration of old or devitalized trees. Manuring can increase yield but not quality. Stable or other organic manure is preferable and its use in various local experiments has increased yield remarkably. Experiments with artificials have so far often given contradictory results, a fact which is attributed to the unequal and insufficient rainfall of the seasons during which the experiments ran. However, it appears that potash has a markedly favourable influence on yield of oil and that while nitrogenous manures increase growth and yield in favourable seasons, they act as depressants in times of drought. Green manuring where practised is beneficial. Irrigation has been shown slightly to increase yield and it also has the merit of enabling a green manure to be grown. The olive can support without inconvenience 5 g. dry residue and 2 g. chloride per litre. Pests and diseases are described in some detail. Throughout the paper there are references to the experimental work of the Service de la Ghaba, founded in 1730, which is in effect a syndicate of olive

growers financially supported by a cess and charged with the supervision of the olive industry with powers of action against incapable, absentee or other unsatisfactory proprietors. They own an experimental oil-refinery and orchard, buy and distribute propagating material and give local pruning demonstrations.

535. TALBERT, T. J. 634.1/8

**Fruit varieties for Missouri.**

*Bull. Mo. agric. Exp. Sta.*, 371, 1936, pp. 56.

Brief descriptions are given of varieties of apples, pears, quinces, peaches, nectarines, cherries, plums (European, damson, Japanese and native), grapes, strawberries, and bramble and bush fruits, which are recommended for commercial or garden planting in Missouri. A short section is devoted to the general pollination requirements of these fruits.

536. BROOKS, L. E. 634.1/7

**Tree fruit varieties in north Texas.**

*Bull. Tex. agric. Exp. Sta.* 535, 1936, pp. 26.

A large number of varieties of deciduous fruit trees were planted at the Wichita Valley Station in 1926, and observations on their performance up to the end of 1935 are here reported. *Apples and pears.* These have proved unsatisfactory owing to their susceptibility to cotton root rot, and it is recommended that they should only be planted where this disease is not prevalent. The most suitable varieties would appear to be the apples Delicious, Early Harvest, Golden Delicious, Jonathan and King David and the pears Bartlett, Garber and Keiffer. *Apricots.* Moorpark has done very well; other varieties have died out or grown relatively poorly. *Cherries.* Five varieties of sour cherry died out within 4 years. *Peaches.* Many varieties have grown well, but their cropping has depended primarily on their resistance to late spring frosts. Records of blossoming time, harvest period and fruitfulness are tabulated, and a figure is given showing peach yields during 3 years of spring frosts expressed as percentages of yields obtained in 2 years without frost. Brief descriptions are given of some 70 varieties. Dr. Burton, Early Wheeler, Fredericka, J. H. Hale and Salwey, especially the first-named, are recommended for commercial purposes. *Plums.* Varietal differences in time of blossoming, harvest period and fruitfulness of plums and prunes are tabulated, and brief descriptions are given of some 40 varieties. Recommended varieties include America, Burbank, Compass Cherry, Gold, Munson, Omaha, Opata, Sapa and Waneta. *Quinces.* Not recommended, the 3 varieties tried having failed completely.

537. GRUBB, N. H. 634.23

**Varieties of cherries.**

*Annu. Rep. East Malling Res. Sta. for 1936*, A20, 1937, pp. 285-7.

The number of distinct cherry varieties under trial at East Malling is at present about 150. Considerable confusion in nomenclature is found to exist. The chief requirements of a good commercial variety are discussed and special attention is paid to varieties found to be most resistant to various diseases. A few notes are given on fruit quality and cropping.

538. SPEIR, G. 634.11-1.563.1

**Apples. An amateur's notes and an experiment.**

*J. roy. hort. Soc.*, 1937, 62 : 83-6.

Certain varieties of apples have their colouring greatly intensified by being temporarily stored stem downwards in close rows on a well mown grass lawn for periods of from 3-12 days. The fruit should be covered with nets to protect it from birds. The treatment takes place from August 20th to the end of October, the date and length varying with the variety. Apples which have responded well to this treatment are James Grieve, Cutler Grieve, Epicure, Lady Sudeley, Rival, Cox's Orange Pippin. Apples which have failed to respond adequately are Golden Spire, Lane's Prince Albert and Ecklinville. Removal from grass to storage proper should be done on a dry day.

539. SHCHERBINA, M. L. 634.21  
**A study on five groups of apricots assembled in the Acclimatization Gardens of the Academy of Sciences of the Ukrainian S.S.R.** [Ukrainian, English and Russian summaries.]  
*Publ. Inst. Bot. Acad. Sci. Kiev, Ukraine*, 1936, pp. 120, bibl. 21.  
 Attempts are being made to extend apricot growing areas from their present limit somewhat south of latitude 48° N. to the forest-steppe region of the Ukraine which lies chiefly between latitudes 50° and 52°. The problem is being investigated by the Section of Acclimatization in four stages:—(1) By forming a collection of local and introduced types; (2) by studying these types with a view to selecting material suitable for breeding new varieties; (3) by breeding new varieties; and (4) by testing these new varieties in various parts of the Ukraine. The present paper is concerned with the second stage, viz. a study of the different groups of apricots assembled in the Acclimatization Gardens of the Academy of Sciences at Kiev. At the outset of 1934 five groups, three of which consisted of local types, were distinguished: (1) A local, small-fruited type represented by 44 trees. These have, on the whole, shown a satisfactory degree of resistance to low temperatures, and 6 relatively large-fruited trees have been selected for hybridization purposes. The remainder have been discarded. (2) A large-fruited type imported from the Crimea and represented by 12 trees. These have, for the most part, proved distinctly less frost-resistant, but 10 trees have been retained for further investigation, 3 of which are considered to show particular promise for breeding work on account of their relatively large, good quality and well coloured fruits and their satisfactory degree of resistance to frost. (3) A group of 87 trees introduced from Kazakhstan. These have shown a very low degree of resistance to frost and most of them have grown unthrifly, so that little hope is entertained that any of the individuals will prove useful in breeding work. (4) A local collection of 11 trees characterized by healthy, vigorous growth and low cropping. This group has not yet been sufficiently studied to indicate its possible value for hybridization purposes. (5) A local, green fruited group of 5 trees, which have been discarded on account of the small size of their fruits. The characteristics of the more promising types in the first two groups are described in detail with the help of diagrams of their fruits. Score cards for fruit quality and chemical analyses are also included in an extensive appendix.
540. TALBERT, T. J. 634.25  
**Missouri peach culture.**  
*Bull. Mo. agric. Exp. Sta.* 380, 1937, pp. 30.  
 Short sections are devoted to sites and soil, planting, the care of young and mature orchards, fruit thinning, harvesting, and pests, diseases and spraying programmes. Particular attention is paid to varieties and pruning. Descriptions are given of a number of varieties and recommendations made for commercial planting. Instructions are given for pruning 4 types of tree.  
 1. *Young trees.* The trees are generally headed back to 16–24 in. During the first 3–4 years the object of pruning is to produce a strong, well-balanced framework, which will support heavy crops without breaking the branches. In form the tree should be bowl-shaped and spreading to allow maximum colour development in the fruit. Too much pruning, however, is likely to be more detrimental than too little.  
 2. *Bearing trees.* Where there is a danger of late spring frosts injuring a high proportion of fruit buds, winter pruning should be delayed, if practicable, until blossoming starts. Where this is impossible a moderate tipping back of fruiting shoots by about  $\frac{1}{4}$  to  $\frac{1}{3}$  is not likely to endanger crop prospects appreciably, since only the apical buds, which are the most susceptible to low temperatures, are removed. The thinning out of shoots, however, should be left until late May or early June.  
 3. *Winter-injured trees.* Following the destruction of the entire crop the trees may with advantage be headed back as far as the 2-year-old wood. This affords an opportunity to lower the top and correct faults in the shape of tree. The rank growth resulting from heading back should be thinned out early in the summer. Cutting back into 3- or 4-year-old wood is considered to lessen the chances of fruit bud formation and is regarded as unnecessary except where the wood has been seriously injured or killed by

cold. 4. *Trees grown only for 6 to 8 years.* In certain parts of Missouri it is a practice to discard and replant peach trees when 6-8 years old. In such cases little or no pruning is required after that given to the trees at planting time.

541. SEFICK, H. J. AND BLAKE, M. A. 634.25 : 581.145.2

**The external characters of green fruits of the peach are valuable aids in varietal identification.**

*Proc. Amer. Soc. hort. Sci. for 1936*, 1937, 34 : 5-8, bibl. 7.

From a study of 195 varieties it was found that peach fruits could be identified at the pit-hardening stage from the following characteristics:—General form (9 groups), shape of base (5 groups), shape of the apex or distal end of the fruit (3 groups), shape of the apex tip (6 groups, each of which may be subdivided), pubescence and size of fruit.

### Breeding.

542. SPINKS, G. T. 634.11-1.523

**Apple breeding investigations. 1. Results obtained from certain families of seedlings.**

*Annu. Rep. Long Ashton Res. Sta. for 1936*, 1937, pp. 19-49, bibl. 4.

The data here presented were obtained from 1,300 seedlings of dessert, culinary and cider apples. Of these 666 are included in 45 families obtained from controlled crosses. The largest family contains 103 seedlings, another contains 53 and 7 others include more than 20 individuals. The data obtained from families containing less than 10 seedlings are referred to only in the text and are not tabulated. Again data obtained from open pollinated seed are only included in the tables in the case of families of special interest. The analysis of results is discussed under the following headings, results being also tabulated in every case: fruit shape, fruit size, fruit colour, ground colour of fruit skin, russet, flesh, flavour, season of use, use of seedling fruits, time of blossoming, size of tree, habit of tree, susceptibility to mildew, scab and canker. It is noted that no family shows any sharply discontinuous segregation of any character. Varieties with the most strongly marked characters have produced the largest proportion of seedlings showing similar characters. Results support the view that most of the characters considered are influenced by polymeric factors. It is suggested that the practical breeder of cultivated apples should select parents which do not greatly differ and which have all the desirable qualities well-marked.

543. TYDEMAN, H. M. 634.11-1.523

**Experiments on hastening the fruiting of seedling apples.**

*Annu. Rep. East Malling Res. Sta. for 1936*, A20, 1937, pp. 92-9, bibl. 12.

After divertingly tapping the stores of horticultural wisdom known to such ancients as Theophrastus (370-285 B.C.) the author briefly describes the results of experiments which indicate the use of dwarfing rootstocks as the quickest method for hastening the fruiting of new seedling apples. This method compares favourably with attempts to gain time by pruning, by top-working or by growing in pots with restricted roots.

544. LINCOLN, F. B. AND McCANN, L. P. 634.11 : 576.312.35

**Polyplody in native species of *Malus*.**

*Proc. Amer. Soc. hort. Sci. for 1936*, 1937, 34 : 26, bibl. 2.

The following chromosome numbers were found in seedlings of native species of *Malus* belonging to the taxonomic section *Chloromeles*: *M. platycarpa* 68, *M. ioensis* 34, *M. angustifolia* 34, *M. glaucescens* 68, *M. glabrata* 68, *M. lancifolia* 51, *M. coronaria* 68, and *M. bracteata* 51.

545. DAHL, C. G. 634.11 : 631.52  
***Malus prunifolia* Borkh. and *Malus baccata* Borkh.** as ancestors of cultivated apple varieties.\*  
 Reprint from *Svensk bot. Tidskr.*, 1936, 30 : 483-92, bibl. 47.  
 A study of the literature on apple species and hybridization from the 18th century onwards has indicated that, contrary to the opinion of a number of authorities, neither *Malus prunifolia* nor *M. baccata* is a parent of the Astrachan or other commercial apples raised in Europe. Only one large-fruited American apple of proved commercial value, Wealthy, is apparently a hybrid, though not in the F1 generation, between one of these species and *Malus pumila*. Hybrids of similar parentage have, however, been raised at the Central Experimental Farm, Ottawa, and at the New York State Experiment Station, Geneva, and it seems probable that some of these will prove of commercial value, especially under cold climatic conditions.
546. SEN, P. K. 634.11 : 581.14  
**Some observations on the time of development of the fruit, seed and embryo in apple.**  
*Annu. Rep. East Malling Res. Sta. for 1936*, A20, 1937, pp. 137-41, bibl. 8.  
 Determinations at approximately weekly intervals during June, 1936, and finally when the fruits were mature showed that in Beauty of Bath and in Bramley's Seedling apples the seed had reached nearly full size by the end of June, when the fruit had reached  $\frac{2}{3}$  its final width. The embryos started to develop rapidly in the middle of June. The development of the embryos of the early maturing Beauty of Bath was always in advance of that of Bramley's Seedling embryos. The periodicity of development observed is similar to that noted by other workers with stone fruits. It is suggested that the considerable embryo abortion in Bramley's Seedling is probably related to the fact that it is a triploid.
547. SCHMIDT, M. 575.252 : 634.1 + 634.2  
**Somatische Mutationen beim Kern- und Steinobst und ihre züchterische Bedeutung.** Sammelreferat. (Bud mutations in pome and stone fruits and their importance in breeding. A summary.)  
*Züchter*, 1937, 9 : 81-91, bibl. 48.  
 In this much documented and useful summary the author considers the more important instances of bud mutations noted in pome and stone fruits and their importance to the plant breeder. He considers them as they affect the following features:—Colour and structure of fruit skin, fruit flesh, fruit size, fruit shape, time of ripening, taste, seed content and colour of pericarp, size of flower, leaf shape, leaf insertion, leaf fall, leaf colour, shape of growth, pollination, susceptibility to climatic factors and to parasitic attack, and reversion to type. In addition he discusses the quite common incidence of chimaeras. Finally he notes the use made of useful mutations and the possibilities afforded by them of introducing "improved" strains. At the same time the danger of propagating bud mutations less desirable than the original is stressed. The author considers that so-called "degeneration" in plants may sometimes be rightly attributed to the unwitting propagation of inferior mutations.
548. WILCOX, A. N. 634.13-2.111  
**Material for the breeding of winter hardy pears.**  
*Proc. Amer. Soc. hort. Sci. for 1936*, 1937, 34 : 13-5.  
 A collection of some 50 newly raised and introduced pear varieties at the Minnesota Fruit Breeding Farm is divided into 3 groups according to the degree of hardiness shown during the very cold autumn of 1934 and the winter of 1935-36. The varieties were each represented by several trees ranging from 3 to more than 10 years old, and included types of the following species: *Pyrus communis*, *P. ovoidea*, *P. ussuriensis*, *P. betulaefolia*, *P. Bretschneideri*, *P. phaeocarpa* and *P. chinensis*.

\* In English.

549. MATHER, K. 634.22 : 576.3  
**Notes on the cytology of some *Prunus* species.**  
 Reprint from *Genetica*, 1937, 19 : 143-52, bibl. 10.  
 Twelve plants of *Prunus cerasifera*, the myrobalan or cherry plum, including 9 wild seedlings from the Caucasus, proved to be diploids ( $2n = 16$ ) despite their very diverse appearance. Among seedlings of *P. spinosa*, the sloe, an intra-specific polyploid series was found, although previously this species had always been reported as tetraploid. The forms found were diploid ( $2n = 16$ ), triploid ( $2n = 24$ ), tetraploid ( $2n = 32$ ), pentaploid ( $2n = 40$ ) and hexaploid ( $2n = 48$ ). Amongst varieties of *P. insititia*, the damson, and *P. domestica*, the European plum, all were hexaploid ( $2n = 48$ ), but amongst 9 seedlings of the latter species two were found with approximately 72 chromosomes (i.e. nonoploids). Two plants of *P. cerasifera* showed failure of pairing at metaphase of meiosis in some pollen mother cells, and, in one of them, this resulted in the formation of restitution nuclei and unreduced gametes. The production of unreduced gametes has thus been demonstrated, or shown to be probable, in all the species examined, with the exception of *P. insititia*. It is concluded from these results that, as Crane and Lawrence have suggested, the hexaploid plum probably arose from the triploid hybrid between *P. spinosa* and *P. cerasifera* by the formation and functioning of unreduced gametes, rather than by somatic doubling.
550. BLAKE, M. A. AND CONNORS, C. H. 634.25-1.523  
**Early results of peach breeding in New Jersey.**  
*Bull. N. J. agric. Exp. Sta.* 599, 1936, pp. 32, bibl. in text.  
 The history of peach breeding trials carried out by the N.J. Agricultural Experiment Station from 1907 onwards is reviewed. The characters transmitted by self-pollinated Belle, Elberta and Early Crawford trees are listed in some detail, while those transmitted by Lola, Dewey, Arp, Greensboro, and Slappey are noted more briefly. Notes are supplied on the progeny from the following crosses:—Belle  $\times$  Greensboro, Belle  $\times$  Early Crawford, Belle  $\times$  Elberta and the reciprocal cross, Elberta  $\times$  Early Crawford and the reciprocal cross, and Lola  $\times$  Arp. The characters used in inheritance studies include flesh type and adhesion of the stone, blossom type, leaf blade shape, glands, fruit buds, hardiness and edible quality. These are classified and described briefly. Finally, descriptions, together with their parentages, are given of 18 new varieties raised in New Jersey.

*Rootstocks.*

551. BAGENAL, N. B. AND OTHERS. 631.541.11 : 634.11 + 634.13 + 634.22  
**A practical evaluation of rootstocks in commercial circulation.**  
*Annu. Rep. East Malling Res. Sta. for 1936*, A20, 1937, pp. 281-4.  
 At a meeting of nurserymen held at East Malling in the summer of 1936 the experimental findings with regard to fruit tree rootstocks in the south-east of England were summarized in their application to commercial practice and discussed. In this paper recommendations based on that discussion are made and should serve as a guide to the rootstocks now available. *Apples*. Notes are given on Malling IX = Jaune de Metz, Malling I and II = Rivers' Broadleaf and Doucin, Malling V\* = Doucin amelioré, Malling XVI = Ketziner Ideal, Malling XII and XIII, Malling IV\* and VII\*. *Pears*. Quinces A, B and C, and layered pears belonging to Malling group C, the round-leaved thorny, *P. communis* type. *Plums*. Myrobalan B, Brompton, Common Mussel, Common Plum\*, Marianna, Pershore, Brussels\*, St. Julien\*.

\* Stocks thus marked show certain unsatisfactory characteristics.

552. TYDEMAN, H. M. 634.11-1.541.11 : 581.144.2  
**The root systems of some new varieties of apple rootstock.**

*Annu. Rep. East Malling Res. Sta. for 1936, A20, 1937, pp. 87-91, bibl. 5.*

Results are tabulated and discussed of an analysis of the root systems of 4-year-old trees of Lane's Prince Albert apples on nine rootstocks raised from seed from a cross between Malling VIII and Malling IX. Part of the trees were excavated in full by the methods used by Rogers [*Ibidem*, 1926-7, II. Supplement, A10, pp. 31-43] and part were dug up more summarily. The large variations found in amounts of fibre are noted. Four illustrations show root systems possessing much fibre mainly in the upper part of the system, much fibre distributed evenly, little fibre mainly in the upper part of the system and little fibre evenly distributed.

553. SPINKS, G. T. 634.11-1.541.11  
**Investigations on the variability of apple trees on seedling and on clone rootstocks. Progress report. I.**

*Annu. Rep. Long Ashton Res. Sta. for 1936, 1937, pp. 50-65, bibl. 5.*

The material on which observations were made was:—(1) Mixed seedlings of unknown origin, (2) Hampshire Crab seedlings, (3) Wootton's Crab seedlings, (4) New Forest Crab seedlings, and (5) *Malus acerba* seedlings. These were grown 2 years in the seedbed and were then transplanted to nursery rows. They were graded according to type of root system and according to size at time of transplanting. The first 4 sets of stocks were worked with Bramley's Seedling and the last with Newton Wonder, propagation being by buds and, where this failed, by grafting. The resulting trees were run up to full standards and were headed at just over 6 ft. Observations were made on the growth of these trees and of various batches of trees on clonal stock for comparison. The conditions in the nursery were not those most favourable to the production of uniform trees, but they were the same both for seedling and clonal stocks. The clonal material used included Malling XII and XIII and a number of clones E7, F12, etc., raised at Long Ashton. In some years the clonal stocks were graded in the nursery, but such grading was by weight and does not exactly correspond with the grades of the seedling stocks. In other years only a single medium grade of clonal stock was planted, the large and small plants being discarded. Records of the size of trees, chiefly as measured by stem diameter, are tabulated and the coefficients of variability given in each case. The author summarizes as follows:—“ . . . On the material investigated, the size of young trees, up to five years of age in the nursery, does not appear to be significantly more variable on mixed seedling stocks or on seedlings of four separate varieties, than on clone stocks. Grading of either seedling or clone stocks before planting in the nursery has not resulted in greater uniformity of the trees. Trees in orchards, six years or less after transplanting from the nursery, were found to be equally variable on clone stocks and on single variety seedling stocks. Variability is greater on the mixed seedling stocks, where the trees were all transplanted from the nursery entirely without selection. The trees have not yet provided data on the variability of blossom formation and cropping.”

554. PALMER, R. C. AND HEWETSON, F. N. 634.11-1.541.11 : 581.144.2  
**Stock and scion relationships in some four-year-old apple trees.**

*Sci. Agric., 1937, 17 : 551-62, bibl. 13.*

The root systems of 174 4-year-old apple trees comprising 14 scion varieties piece-root-grafted on 1-year-old seedlings of Canada Baldwin were excavated and their root weight and root distribution recorded. Significant differences in the average root weights were found under the various scion varieties. The varieties U.S.D.A. No. 227 and Hyslop, both strong growers, induced exceptionally vigorous growth in the seedling roots on which they were grafted. The inherent variability of the seedling roots was reflected in the scion varieties grafted on them. Scion varieties differed in their ability to overcome variation in the seedling roots on which they were grafted. They exercised a significant influence on the spread and depth of root growth made by the seedling stocks. The technique of excavation and a device for determining root distribution are described with illustrations. Scion roots were included when comparing weights

of roots and tops, but in considering the effect of scion variety on root habit of the seedling stock the scion roots were omitted as not forming part of the seedling plant.

555. KEMMER, E. AND SCHULZ, F. 631.541.11 : 634.11 + 634.13  
Die Bedeutung des Kernobstsämlings als Unterlage. Teil I, Entwicklung der Sämlinge diploider und triploider Apfel- und Birnensorten and Weitere Ergebnisse der Sämlingsentwicklung diploide u.s.w. . . . (The importance of pome fruit seedlings as rootstocks. Part I, The growth of seedlings of diploid and triploid apple and pear varieties and Further results in the investigation of the above.)

*Landw. Jb.*, 1934, 79 : 794-824, bibl. 10 and *Ibidem*, 1936, 83 : 297-319, bibl. 3.

The trials described in the first paper included seedlings from 6 diploid apple varieties and 2 apple species, 6 triploid apple varieties, 4 diploid pear varieties and 2 triploid pear varieties. Results obtained showed definitely that the seed of triploid varieties is quite unsuitable for the production of rootstocks. [This is based on the small percentage of seedlings obtained and on the weak growth of these. ED.] Among diploids considerable variation was observed in the seedlings. In the second set of trials 12 diploid and 5 triploid apple varieties and 5 diploid and 2 triploid pear varieties formed the experimental material. They came from different sources and particular attention was paid to the effects of origin. The authors summarize as follows:—"These investigations have confirmed the fact that the number of seeds per 100 g. fruit weight is largely dependent on the number of chromosomes. With one exception, the Rheinischer Bohnapfel, triploid forms produce fewer seeds per 100 g. fruit weight than diploids. Comparisons show that in the diploids the number is in some cases constant, as in Weisser Winterapfel, and in others is very variable. In most cases the chromosome complement can be determined by noting the ratio of seeds capable of germination to those incapable of germination. Triploids normally contain very many blind seeds. Again the Bohnapfel is an exception. The large number of good seeds general in diploid varieties was not found in Kasseler Renette or in Louise Bonne, the number varying greatly according to origin. The difference in performance between diploids and triploids was very noticeable in the first year. The standards of comparison used were:—(1) number of seedlings as percentage of stratified seeds, (2) number of 1st quality plants, (3) average shoot length and girth of plant at root collar. A computation of the average deviation gave results which make it easy to distinguish the diploid or triploid nature of a variety. Considerable variation occurs among the diploids, but the triploids show such meagre growth as to be out of the question for the production of rootstocks. The diploids need further investigation and in particular all varieties hitherto considered good seedling producers need testing according to their origin. In this way only can one eliminate chance results due to climate, soil, nutrition, etc. This will also be the only way to determine the capacity for variation in performance inherent in any variety and to establish a strain showing constancy. The fresh varieties introduced into the trials this time confirm previous results. Goldparmäne is noticeable for its extreme vigour of growth."

556. TYDEMAN, H. M. 634.22-1.541.11  
New varieties of rootstocks for plums. II. A final report on seedlings of *Prunus divaricata*.

*Annu. Rep. East Malling Res. Sta. for 1936*; A20, 1937, pp. 100-4, bibl. 3.

The author concludes his report of trials with 150 seedlings collected from 30 wild trees of *Prunus divaricata* growing in South-eastern Europe and Asia Minor. (Although these stocks were originally received at Merton under this name, their botanical characters showed them to be similar in all essential respects to varieties of *P. cerasifera*.) Wide differences were found to exist in vigour and productivity by the end of the 4th year when budded with Czar and some 12% entirely failed to make trees when so budded. Since the survivors were in these trials considered to be less productive in their early years than rootstock varieties already in use, they were adjudged unworthy of further trial.

*Rootgrowth.*

557. PAVLYCHENKO, T. K. 581.144.2  
**The soil-block washing method in quantitative root study.**  
*Canad. J. Res.,* 1937, 15, Sec. C, pp. 33-57, bibl. 39.  
 An excellent description is given of the soil-block washing method used by the author for studying roots of weeds and certain crops. A trench is dug round the block of soil containing the roots to be studied. The soil block is then encased in a wooden framework, metal bars are driven under the bottom of the block and fastened to the casing. The block, thus reinforced, is tipped over on its side, hoisted up by a crane, and placed in a tank where it is soaked in water for several hours. The soil is then gently washed away with water flowing from a fan-shaped nozzle with numerous fine jets. Washing is begun at the bottom of the block so that the greatest depth and spread of the roots can be observed. As washing proceeds, notes are made, and the position of each main root is charted on graph paper. It is found that even the finest roots are preserved by this technique. If desired, the roots can then be kept in fresh condition for several months in 3 to 4% formaldehyde solution. Finally the root system is laid on the black floor of a large shallow tank containing 3" to 6" of water. The main roots are held in their original relative positions (in one plane) with small weights, and the smaller roots are allowed to float into natural positions. The whitish roots show up well against the black background, and the roots in various regions can be counted and measured. Photographs can also be obtained. Permanent mounts can be made by placing a mounting background under the root system in the analysing tank, and letting the water out gradually. The size of block used varied from a 14" cube for cereal plants 5 days old to 40" × 40" × 70" for 3-year-old grasses. Several examples are given, and it is stated that the root systems of 3-year-old single plants of slender wheat grass, brome grass and crested wheat grass measured 9.9, 65.2 and 315.4 miles respectively. The greater proportion of these amazing totals were branch roots of 2nd and higher orders, which were estimated from samples. A short review is given of methods of studying root systems, particularly of small plants. This is not exhaustive, and omits much recent work on fruit plants (see *H.A.*, 1935, 5 : 286 and 1934, 4 : 175 and 329). W.S.R.
558. BOYNTON, D. AND SAVAGE, E. F. 634.11 : 581.144.2  
**Root distribution of a Baldwin apple tree in a heavy soil.**  
*Proc. Amer. Soc. hort. Sci. for 1936,* 1937, 34 : 164-8, bibl. 7.  
 An excavation trench, 2 ft. wide and 4 to 5 ft. deep, was dug across a 25-year-old Baldwin apple tree to a distance of 13 ft. on either side of the trunk. The soil was removed in small sections and the roots present were sifted out, sorted, dried and weighed. The results indicate that the root system in the surface foot extended somewhat further than 13 ft. from the trunk, whereas at a depth of 5 ft. it extended not much more than 8 ft. from the trunk. The greatest concentration of absorbing roots was found in the upper 3 ft. within 8 ft. of the trunk. Although the density of fibrous roots decreased directly with distance from the trunk, there was about the same weight of fibrous roots in the soil 6 to 12 ft. from the trunk as in the soil within 6 ft. of the trunk. These results agree in general with the findings of other workers.
559. SAYED, I. A. 634.1/7-1.548  
**Root exposure.**  
*Poona agric. Coll. Mag.,* 1937, 28 : 144-7.  
 In certain parts of India (e.g. Deccan) root exposure of certain trees after they have begun to bear normally is a regular orchard practice. It is used with certain deciduous trees which have more than one flowering period in a year such as some varieties of citrus, pomegranate, fig, guava, grape and rose, with the object of providing an enforced resting period and so preparing the way for an abundant yield in one season only and eliminating the almost continuous production of poor quality fruits with consequent exhaustion of the tree. The treatment is also used to force non-fruiting trees into bearing. Having selected the season in which the crop is desired, irrigation is withheld for from 4 to 6 weeks depending on the season. To flower in

June-July withhold water during whole of April and first week in May; to flower in February-March withhold water mid-December to mid-January. Opportunity is taken during the cessation of irrigation to plough or dig the orchard and clean up the trees. In the last week of the rest period the roots are exposed to a radius of 3-4 ft. from the stem and to a depth of 4-6 in. Fibrous and wiry roots are pruned back but the larger roots are not touched. After a week the roots are re-covered with soil (fresh if possible) to which some suitable manure has been added. The trees are irrigated and should flower in a month. Certain crops and soils require slight modifications of resting period and irrigation. It is emphasized that the check must be gradual rather than sudden or the trees may fail to flower.

*Pollination.*

560. LATIMER, L. P. 634.11 : 581.162.3  
**Self- and cross-pollination in the McIntosh apple and some of its hybrids.**  
*Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 19-21, bibl. 3.*

Pollination tests were started at the New Hampshire Experiment Station in 1934 to determine the interrelations between McIntosh and some of its more promising seedlings, namely Cortland, Melba, Early McIntosh, Milton and Macoun. Self- and cross-pollinations were made with all these varieties, with the exception of Early McIntosh which was never used as a ♀ parent, and Macoun which was not tested as a pollinator for McIntosh. Starking was included as a standard pollinator for comparison. Cross-pollination resulted in 60% or more of the blossom spurs setting fruit in every case except where Early McIntosh was used to pollinate Cortland (5%). With self-pollination, however, the percentage of blossom spurs setting fruit ranged from 1 to 3 in all the varieties except Melba, in which a 22% set was obtained. On the other hand, the Melba fruits resulting from self-pollination contained fewer seeds—generally none—than did fruits of the other varieties.

561. LATIMER, L. P. 634.11-1.547.5 : 581.162.3  
**The effect of reducing the number of functioning stigmas on fruit-setting and characteristics of the McIntosh apple.**  
*Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 22-5, bibl. 2.*

In tests carried out in New Hampshire from 1929 to 1934 the removal of some of the stigmas of McIntosh flowers did not affect significantly the percentage of blossoms setting fruit when these were cross-pollinated with Red Astrachan or Delicious pollen. From 1930 to 1934 the average percentages of blossom spurs setting fruit were:—Cross-pollination of 1 stigma 74.3%, cross-pollination of 5 stigmas 68.7%, and self-pollination of 5 stigmas 3.2%. When all the stigmas were removed and pollen applied to the style stubs, no fruit was set. The reduction of the functioning stigmas to one in each flower produced a slight increase in the number of seedless locules in the fruit, a decrease in the number of seeds per fruit, and an increase in the number of lopsided fruits. The increase in the number of empty locules and lopsided fruits was, however, much less than in the case of self-pollinated fruits. A correlation coefficient of 0.942 was found to exist between the number of empty locules and the percentage of lopsided fruits. The fact that, under favourable conditions, McIntosh can set a normal crop of fruit with less than 5 functioning styles per flower is thought to explain the comparatively good sets sometimes obtained when frost damages the blossoms just as they are opening.

562. LATIMER, L. P. 634.11 : 581.162.3 : 638.14  
**Can bees retain pollen of early apple varieties for effective pollination of later blooming sorts?**  
*Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 16-8.*

When bees were taken from a blossoming orchard in 1935 and 1936 and were stored for 48 and 96 hours at 45° F. prior to placing them in cheesecloth cages enclosing flowering 16-year-old McIntosh trees, the average seed content of the fruits set was almost identical with that of fruits

set by self-pollination, with or without the assistance of bees. In 1935 neither treatment resulted in an increased set of fruit over that of the self-pollinated tree, but in 1936 the insertion of the bees (stored for 2 days only) resulted in a set nearly twice as large as that from self-pollination in the absence of bees. This latter result is thought, however, to be due to conditions being unfavourable for self-pollination in 1936, and it is concluded that pollen, which may be gathered by bees 2 or more days before they visit flowers requiring pollination, is of little or no value for pollination purposes. In the same series of tests bees removed from the orchard at night and placed immediately in the cage produced nearly double the set and a slightly larger seed content than did self-pollination assisted by bees which had not been previously exposed to apple blossoms.

563. JOHANSSON, E. AND CALLMAR, G. 581.162.3 : 634.22 + 634.23  
Bidrag till kännedomen om befruktningsförhållandena hos plommon och körsbär. (**Pollination of plums and cherries.**) [English summary 2 pp.]  
*Contr. Swedish Perf. Ctee Orch. Res.* 42, 1936, pp. 38, bibl. 22.

The results of work on plum and cherry pollination at Alnarp in the years 1931-36 and of plum pollination at Stockholm are given with numerous tables and lists of varieties found suitable for cross pollination of self-sterile varieties.

564. CRANE, M. B. AND BROWN, A. G. 634.23-1.522 : 581.162.3  
**Incompatibility and sterility in the sweet cherry, *Prunus Avium* L.**  
*J. Pomol.*, 1937, 15 : 86-116, bibl. 26.

The present report embraces the results obtained during the last 6 years at the John Innes Horticultural Institution, on the incompatibility and sterility of cherries both in its genetical and practical aspects. The sweet cherry is always self-incompatible, while of the 66 varieties investigated 45 were found to belong to 11 incompatible groups within which all self- and cross-pollinations fail. The difference between incompatibility and sterility is pointed out. Incompatibility is determined by genetic factors which control pollen tube growth. Another essential feature of the genetic behaviour of incompatibility is that under normal conditions pollen cannot function in the style of a plant carrying the same factors as the pollen. This failure to obtain fruit is due to the arrest of the pollen tube growth in the stylar tissue and not to any defect in the pollen or ovules. Sweet cherries also exhibit degrees of generational sterility affecting the proportion of fruits which set and reach maturity. The chief signs are aborted pollen and imperfectly developed or non-viable seeds. The considerable confusion existing in the nomenclature of cherries is mentioned and is of importance in view of the necessity for interplanting compatible varieties to ensure cross pollination. In this latter connection the table embodying results of 236,000 experimental pollinations and occupying eleven pages should prove of immense practical value to growers.

#### *Growth, Nutrition, etc.*

565. WILCOX, J. C. 634.11 : 581.14 : 631.55  
**Field studies of apple tree growth and fruiting. I. Sampling and measuring terminal shoots. II. Correlations between growth and fruiting.**  
*Sci. Agric.*, 1937, 17 : 563-72, bibl. 13, and 573-86, bibl. 32.

I. Investigations were conducted into the sampling of terminal shoots, and into the measurement of the diameter of the terminal. The principal findings were as follows:—The more upright the direction of the terminal growth, the greater was its length. Those terminals growing at any one angle with the horizontal averaged a little longer at the top of the tree than at the bottom, though the difference was not significant. A sample of terminals growing at an angle with the horizontal of 15 to 75 degrees proved the most satisfactory type of sample of those studied and tested. The correlation between the terminal length and terminal diameter decreased

as the position of recording the diameter was varied from the base to the tip. The correlation between the increase in trunk circumference and the terminal diameter decreased in the same order, though the rate of decrease was much less. It is suggested that if it is desired to eliminate from the records of terminal diameter the effects of terminal length, the most satisfactory position at which to take the measurement is close to the tip.

II. Studies were made of the relationships between measurements of growth and fruiting of the apple tree. The methods of study included the use of the scatter diagram, of the coefficient of correlation, and of individual tree charting. The investigations covered a six-year period, from 1931 to 1936. The principal findings were as follows:—As the size of the tree increased, the rate of increase in trunk circumference and terminal length tended to decrease. Vigorous trees were found to grow more strongly in all respects than weak trees. Positive correlations were obtained between terminal length and increase in trunk circumference, both in the same year and in alternate years; also between each of these in any one year and the same in alternate years. When, however, the differences in vigour were eliminated, biennial bearing was found to produce a longer terminal growth and a smaller increase in trunk circumference together during one year, and the reverse the following year. The terminal diameter was correlated directly with both the terminal length and the increase in trunk circumference. Negative correlations were found between the percentage bloom or set one year and the same the following year. Negative correlations were obtained between the percentage bloom or set and the increase in trunk circumference, but positive correlations between the percentage bloom or set and the terminal length. [Author's summaries.]

566. PEARSE, H. L.

581.084 : 634.11

**Apple trees in water culture.**

*Annu. Rep. East Malling Res. Sta. for 1936*, A20, 1937, pp. 131-6, bibl. 4.

Three methods of aerating the solution when growing two-year-old, unworked Malling apple rootstocks II and V in water cultures are described. In the "Bubbling" method the trees were grown in 12 inch plant pots which had been coated with paraffin wax. Their roots were immersed in the solution, and aeration was effected by glass tubes leading to the bottom centre of the pots. The air stream was broken into five bubbles by a small Alundun Thimble R.A. 98. Each pot held 8 litres of solution. In the "Circulating" method aeration was effected by removing the solution from the top of the pot, aerating it, and then refeeding it into the bottom of the pot. Circulation was kept up by a suction pump. In the "Spray" method the roots were suspended in the pot and constantly sprayed with the nutrient solutions. These processes are illustrated. The No. Vs made in general more growth than the IIs and leaf fall was earlier in the IIs. Root growth was more normal under the spray method and defoliation was later under this method than under the bubbling method. Iron (supplied as ferric citrate) was more readily available to the trees in the spray method than in the others, and the ability to absorb other ions also varied according to the mode of aeration. No. II was more susceptible to lack of efficient aeration than No. V. The results of the trial are hopeful and indicate that it is possible to get a good performance with apple stocks in water culture given a suitable technique.

567. MACDANIELS, L. H.

634.11 : 581.145.1

**Some anatomical aspects of apple flower and fruit abscission.**

*Proc. Amer. Soc. hort. Sci. for 1936*, 1937, 34 : 122-9, bibl. 1.

McIntosh and, to some extent, Wealthy suffer from the defect of dropping fruits before they are well coloured or before they can be harvested after attaining the desired colour, whereas in varieties such as Rome, Northern Spy and Cortland the fruits may hang on the tree even after they are over-mature. The purpose of the present paper is, in the author's own words, "to describe the structure of the abscission zone of several varieties and some of the details of the abscission process of the flowers and fruit without considering the physiology of abscission or the effect of environment on the formation of the abscission layer". The information presented will, it is hoped, assist in a future study of the physiological factors involved in the dropping of fruits.

568. PICKETT, W. F. 634.11 : 581.144.4 : 581.13  
**The relationship between the internal structure and photosynthetic behaviour of apple leaves.**  
*Tech. Bull. Kans. agric. Exp. Sta.* 42, 1937, pp. 58, bibl. 49.  
 The object of the studies reported in this paper was to determine whether apple varieties differ in the structure of the spongy leaf mesophyll, and if so, to estimate the extent of such differences and their relationship to variations in photosynthetic behaviour of the leaves. The studies were made during the 3 years 1933-35 on orchard and greenhouse trees consisting of 7 varieties, Livland, Wealthy, Jonathan, Delicious, Winesap, Gano and York, and were divided into three distinct phases:—(1) An anatomical study of the leaves. Data are presented showing the relative amounts of spongy mesophyll tissue and the extent of the intercellular space in leaves of the different varieties. The extent of the intercellular space was determined by measuring tracings of projected images with a planimeter and a chartometer. (2) A study of stomatal behaviour. Average numbers of stomata per sq. cm. leaf area were determined in 1933 and 1934 for trees grown in the orchard and in a cool and a warm greenhouse. In the case of the orchard trees the average lengths of the stomata were also calculated. The times of closing of the stomata were studied in the same two years, both of which were unusually hot and dry. With the orchard trees stomata were seldom found to be open after 9 a.m. and frequently were completely or nearly closed by 7 or 8 a.m. (3) A study of the photosynthetic activity of apple leaves. Apparent photosynthetic measurements were made in 3 ways:—(i) By determining the amount of  $\text{CO}_2$  absorbed by a known amount of leaf area; (ii) by determining the weight of dry matter accumulated per unit of leaf area during a definite period; and (iii) by making comparisons of the total acid hydrolyzable carbohydrates at different periods of the day. The results obtained by each method are tabulated and discussed separately, because, as might be expected from the fact that no two of them measure exactly the same plant activities, these results are somewhat conflicting. However, it is regarded as significant that all three methods gave higher values for Livland than for Delicious, since the intercellular space was found to be more extensive in leaves of the former than in those of the latter. The literature dealing with each method is also reviewed. In discussing his results the author compares in particular the three varieties Livland (of Russian origin), York and Winesap. Livland leaves were found to show a high rate of photosynthetic activity per unit leaf area and York leaves a relatively low rate. The relation between the photosynthetic activity and the extent of the intercellular space was similar, generally speaking, in all varieties. From this it is concluded that the anatomical characteristics of apple leaves, as expressed by measurements of the intercellular space, may be one of the factors influencing photosynthetic activity. It is thought that this characteristic probably exerts its influence by governing the diffusive capacity of the leaves and by determining the extent of the moist surface of the mesophyll cell walls bounding the intercellular space. The Livland trees studied were less vigorous than the trees of the other varieties despite the fact that they were photosynthetically the most active. However, the Livland trees were larger per unit of leaf area than the other trees. Thus a typical Winesap tree had about 4·5 times as many leaves and more than twice the total leaf area than a Livland tree, while a representative York tree had over twice as many leaves and nearly twice as large a leaf area. On the other hand, the York and Winesap trees were not so much larger than the Livland trees as their greater leaf areas would appear to indicate. From these results it is concluded that the relative photosynthetic activity per unit of leaf area becomes cumulative over a period of years when the whole tree is considered as a unit. Finally, it is suggested that the low photosynthetic activity of York leaves may be one of several factors closely associated with the biennial bearing habit of this variety.

569. HEINICKE, A. J. AND CHILDERS, N. F. 634.11 : 581.13  
**Influence of respiration on the daily rate of photosynthesis of entire apple trees.**

*Proc. Amer. Soc. hort. Sci. for 1936*, 1937, 34 : 142-4, bibl. 2.

During the period June-October, 1936, a 9-year-old McIntosh apple tree growing in the Cornell University orchard was enclosed in a large glass chamber provided with an inlet and an outlet

for controlled air movement [not described here—ED.]. The average respiration rate per hour at different temperatures was determined during the nights from 7.30 p.m. to 4.30 a.m. and also throughout certain days on which photosynthesis was prevented by excluding light. The results indicate that respiration is markedly increased as the temperature rises, and that at any given temperature there is much greater respiratory activity during the day time than during the night. The occurrence of many fluctuations shows, however, that there were other factors, such as the growth activity of the plant, which also influenced respiration to an important extent. Thus the respiration rate in June is much greater than in the succeeding three months and again declines sharply in October. Measurements of apparent photosynthesis indicate that high mean temperatures greatly reduce photosynthetic activity, and also suggest that a high rate of respiration during the night may exert an inhibiting or "hang over" influence on photosynthesis during the following morning. In general the data presented show that the average rate per hour of apparent respiration of an entire apple tree during the night period amounts to considerably less than 10% of the average hourly rate of apparent photosynthesis during the day, but that during the day time the rate of respiration may be great enough to depress the rate of apparent photosynthesis by as much as 20 to 30% at the higher temperatures.

570. SULLIVAN, J. T. AND BAKER, C. E. 634.11-1.8  
**Effect of cultural treatments on the growth and nitrogen content of apple shoots and spurs.**

*Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 149-54, bibl. 2.*

The nitrogen content and average weight of dry matter in terminal shoots and spurs were determined in several years for Grimes apple trees which had been growing in Indiana since 1924 under three systems of orchard management:—(1) Cultivation with an autumn sown cover crop of winter wheat or rye, (2) permanent blue grass sod with an annual spring application of ammonium sulphate at a rate of  $\frac{1}{4}$  lb. per tree for each year of its age, and (3) a mixed legume sod, chiefly alfalfa, which required cultivating annually up to 1934 before it was properly established. Each treatment was duplicated. Up to the present a correlation has been found between terminal and trunk growth and the nitrogen content of the trees. In the years before bearing started the trees receiving cultivation with annual cover crops made the greatest growth and came into bearing earlier and contained more nitrogen than the trees in blue grass sod receiving inorganic nitrogen. The latter, however, eventually surpassed the cultivated trees in growth, yield and nitrogen content. The leguminous sod plots most nearly resembled the cultivated plots in the early years and the blue grass sod plots in the late years. The amount of spur growth was not always correlated with the amount of terminal growth. Thus in 1933 and 1936 the cultivated plots, by then low in nitrogen and always making less terminal growth, tended to produce a higher dry weight of spur growth than the plots receiving other treatments.

571. WALTMAN, C. S. 581.192 : 634.11 + 634.25  
**A rapid method for determining soluble nitrogen and phosphate phosphorus in woody tissue.**

*Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 130-2, bibl. 6.*

The procedure used by Emmert in Kentucky for determining soluble nitrogen and phosphate phosphorus in vegetable tissues has been modified for use in determining these constituents in apple and peach shoots and leaves. The method is described. In Winesap and Elberta shoots taken in May, 1935, and divided into apical, median and basal thirds, the soluble nitrogen content was found to decrease from the tip to the basal portions. Phosphate phosphorus showed the same trend, though to a less marked extent, in the peach, but varied only to an inappreciable extent in different parts of the apple shoots. Leaf analyses showed no correlation between the soluble nitrogen content and the conditions under which the trees were growing. The accuracy of the method of analysis was checked by making several determinations for each constituent from single extracts. The full results of these determinations have been published elsewhere (*Bull. Ky agric. Exp. Sta., 367, 1936*).

572. OINOUE, Y. 634.13 : 581.144  
 Sur la transmutation reversible de la tige à la racine et vice versa de la poire japonaise Tyôzyûrô. (The transmutation of stem into root and vice versa in the Japanese pear Tyôzyûrô.) [Japanese, French summary.]  
 Reprinted from *J. hort. Ass. Japan*, 1936, 7 : 232-5.  
 From the results of studies on stem and root cuttings of seedlings of the Japanese pear variety Tyôzyûrô the author concludes that the changes leading up to the formation of adventitious roots by stems and of shoots by roots are in the nature of a transmutation and not regeneration of the tissues. By treating stems and roots in different ways [not fully described—ED.] he found that stems could be transformed into roots and roots into stems. When stem cuttings were kept in moist, darkened incubators at 30° C. the cells of the phloem became swollen, the cell walls became barely visible and rapid cell division occurred. Roots developed from the callus at the basal ends of the cuttings. On the other hand, under the influence of sunlight, and especially of the rays of short wave-length, and when the humidity was relatively low, the tissues formed at the cut ends took on the character of stem tissue. Ultra-violet rays checked root development even when the humidity was high. In another experiment seedling trees were planted and treated in two different ways. In the one series the trees were planted shallowly and their stems were gradually earthed up to a height of 30 cm. during the following 3 years. In the second series the trees were planted deeply and the soil was gradually scraped away from the trunks. In the first series the chlorophyll in the buried portions of the stems disappeared after 1 year, and by the third year the anatomical arrangement of the cortex, phloem, and xylem was altered from the ringed formation characteristic of stems to the radial formation typical of roots. The reverse process occurred in the stems which were gradually exposed to light, chlorophyll appearing 2 years after unearthing and the tissues showing a ringed arrangement. Finally, root cuttings, 1 cm. in diameter and 15 cm. long, set with their upper portions exposed to light and their lower portions kept in a nutrient solution in darkness, produced adventitious buds near their apical ends and gave rise to callus from which roots subsequently developed at the base.
573. DAVIS, M. B. 631.8 : 634.1/7  
**Nutrition of fruit trees.**  
 Reprinted from *Rev. Canad. Soc. tech. Agriculturists*, January, 1936, pp. 380-3.  
 In this simply written review the author treats briefly the following points:—The necessity for a balanced ration, the functions of N, P, K and Ca, the physiological disorders due to faulty nutritional balance. A few general recommendations are also made, the necessity for watching foliage before adopting any one system of manuring being stressed.
574. POTTER, G. F. 634.11-1.55  
**Biennial bearing of McIntosh.**  
*Proc. Amer. Soc. hort. Sci. for 1936*, 1937, 34 : 139-41.  
 The destruction of almost the entire 1932 crop by frost and a very heavy crop in 1933 resulted in a distinct biennial bearing habit in McIntosh trees growing at the University of New Hampshire, although this variety is one of the most regular croppers known. In 1935 tests were carried out to determine if thinning the on-year crop to 1 fruit per 50 spur leaves would result in a good crop in 1936. The dates on which the thinning was performed were 20 June (3 weeks after blossoming), 15 July and 10 August. Check trees left unthinned produced the largest yield (687 lb. per tree), though largely of undersized fruits, in 1935, and a very small yield (62 lb.) in 1936. The trees thinned on 20 June yielded 479 lb. in 1935, and 373 lb. in 1936; those thinned on 15 July 462 lb. in 1935 and 168 lb. in 1936; and those thinned on 10 August 390 lb. in 1935 and only 39 lb. in 1936. It would seem, therefore, that early thinning, probably in one season only, will remedy a biennial bearing habit in McIntosh. Late thinning, on the other hand, causes the greatest loss of crop in the year of thinning without any compensating increase in the succeeding year.

575. SIMPSON, R. C. 634.11-1.55  
**Individual tree yield records in a commercial apple orchard.**  
*Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 155-9, bibl. 3.*  
 Individual tree yield records were kept in Indiana for a period of 4 years on 200 acres of apple trees and for 3 further years on about half this area. Scoring was done as near to harvest as possible, the trees receiving numbers of from 1 to 5 according to relative productiveness. The method proved of value in determining which trees could most profitably be removed when the orchard became overcrowded, but, except in cases where the cause of unproductiveness was quite clear, records had to be taken for more than 4 years before definite conclusions regarding tree performance could be drawn. This rather long period of recording was necessary, because some trees, especially when young, tended to have as many as 3 off-years in succession followed by as many years of good to heavy production. Six years' records also brought out some striking information on the effective distance of pollination. Under normal or unfavourable pollination conditions rows of Winesap trees set next to mixed rows of Rome and Wealthy always produced higher yields than trees set one row further from the pollinators. The latter were in each case adjacent to rows of Turley trees, which were originally planted as pollinators, but have since been found worthless for this purpose. Where large bouquets of a pollinator variety were placed between trees in a row, a marked increase in yield was produced only in the nearer half of adjoining trees. From this it is clear that pollinator varieties should be planted on the outside or at least the second row of a block. With regard to the bouquets it was found that only those as large as 6 to 15 ft. long gave satisfactory results. These were cut from filler trees and placed in 50-gallon barrels in which they often remained fresh for as long as 2 weeks.

*Soils.*

576. OSMOND, A. 634.1/7-1.4  
**A survey of the soils of the Long Ashton Research Station farm.**  
*Annu. Rep. Long Ashton Res. Sta. for 1936, 1937, pp. 256-62.*  
 The research station farm comprises 257 acres, 100 of which are under fruit, the remainder being under pasture at present. Some 15 soil series are here differentiated and a short description is given of the salient features of each.
577. OSKAMP, J. 634.1/2-1.4  
**Soils in relation to fruit growing in New York. Part IX. Tree behaviour on important soil profiles in the Newfane-Olcott area, Niagara County.**  
*Bull. Cornell agric. Exp. Sta. 653, 1936, pp. 20, bibl. 6.*

Profiles, texture and pH values were studied in five soil series on which apple orchards had been planted. Ground-water measurements were made to provide an indication of drainage, and root distribution of the trees was studied in each series. Records of yields, age and treatment of the orchards were available. The author concludes that a relationship exists between certain general profile characteristics and orchard development and describes this relationship approximately as follows:—(1) Those soils with a generally brown profile lacking sharp contrasts in colour, with a fairly uniform texture, and particularly without a heavy layer in the subsoil, are productive fruit soils on which trees are large for their age, long-lived and deep-rooted. (2) Soils with a grey layer, a very mottled subsoil, or both, are unproductive, the trees being smaller, shorter-lived and shallower-rooted. (3) Between these two classes are soils which show some greyness and mottling and which, under certain conditions of topography and drainage, may be fairly well adapted to fruit growing. (4) Another class, which usually shows an almost level to depressional topography, and possesses a black top soil, a sharply defined grey layer and a highly mottled subsoil, is unsuitable for fruit. (5) Finally, soils were encountered which were of unmodified glacial-till origin or which possessed unmodified till at shallow depths, and these were also found to be unsuitable for fruit, since their compact nature prevents root penetration and leaves the trees at the mercy of temporary fluctuations in moisture and nutrient supply. It

is noted, however, that it proved very difficult to judge the compactness of this subsoil when an ordinary soil auger was used, and its nature only became apparent when excavations were made or the California soil tube described by Viehmeyer was used. [Similar conclusions regarding soil profiles in N.Y. State were described by A. T. Sweet in *Bull. Cornell agric. Exp. Sta.* 637, 1935, *H.A.*, 1936, 6 : 275. ED.]

578. HOWLETT, F. S. 634.13-1.4  
**Soil management systems in a young Bartlett pear orchard.**  
*Bull. Ohio agric. Exp. Sta.* 578, 1936, pp. 38, bibl. 21.

The growth and cropping of Bartlett pear trees planted as 2-year-olds in 1929 and grown under 4 systems of soil management were observed during the 5-year period 1931-35 at Strongsville, Ohio. The systems compared were:—(1) Cultivation with an annual oat and vetch cover crop, half the plots being ploughed and the remainder disced; (2) Kentucky bluegrass sod with added nitrogen; (3) grass and straw mulch; and (4) alfalfa sod. Each system was triplicated over a 2-acre area, consisting of silty clay soil overlying an impervious subsoil which prevents deep rooting. Rainfall records taken from April to October in each year showed that more than two-thirds of these months had rainfalls below the average, and that in every year the rainfall for 1 to 3 of the months May, June and July was below the average. Under these conditions the following results were obtained:—*Increase in cross-sectional area of the trunks.* There were no significant differences between the mulch and the two cultivation treatments. The increase in girth area of the trees in bluegrass sod was, however, only 62% of that of the trees in mulch, while in the trees in alfalfa it was only 51%. *Height and breadth of the trees at the end of the experiment* showed the same trends as did girth measurements. *Weight of prunings removed per tree.* The approximate values were:—Cultivated 3·4 lb., mulched 2·6 lb., bluegrass sod 10 oz., alfalfa sod 6 oz. *Percentage of flowers developing into fruits.* There appeared to be a small reduction in set on the trees in alfalfa sod, but otherwise there were no appreciable differences. *Total weights of fruit.* The averages per tree were:—Cultivated 45 lb., mulched 43·7 lb., alfalfa sod 21 lb. and bluegrass sod plus nitrogen 16·9 lb. *Numbers and sizes of fruits.* The cultivated plots produced the largest number of fruits per tree, but the mulched plots produced the largest fruits. Under the conditions of this experiment it is considered that inadequate soil moisture was the principal factor restricting the growth of the trees in the bluegrass and alfalfa sod treatments. On the other hand, the cultivation with cover crop system, though resulting in satisfactory growth and fruiting, encourages a rather succulent type of growth which is more susceptible to fireblight. It is thought, therefore, that under conditions where fireblight is prevalent and the moisture supply more satisfactory the somewhat restricted growth obtained under the bluegrass sod system would be preferable to the more luxuriant growth produced by the cultivation plus cover crop system, while under conditions of inadequate moisture supply the mulch system would appear to be as satisfactory as any.

579. ROGERS, W. S. 631.432 : 634.1/2  
**Soil moisture studies. I. Water utilization by apple trees in cultivated and grass orchard, compared with fallow land.**

*Annu. Rep. East Malling Res. Sta. for 1936*, A20, 1937, pp. 105-9, bibl. 2.

The data are based on the records of moisture meters set at 9 in. and 30 in. in fallow land and at 12 in. and 36 in. in a grass orchard and in a cultivated orchard at East Malling during the year 1936. The "soil pull" or suction force at these levels was recorded and is graphed. The pull is nil at saturation and increases as the soil dries. In spite of copious rainfall, 3·95 in. in June and 2·8 in. in July, the soil at 36 in. in the two orchards gradually dried to a pull of over 60 cm. Hg. (or approximately pF 2·9\*) in September. This was due to absorption by plant roots, since the soil at 30 in. in the fallow plot showed practically no drying out. The maximum pull at 12 in. was 50 cm. in the grass orchard which was much less than in previously recorded (drier)

\* pF is the logarithm of the suction force in centimetres of water.

years. The rapid use of water in the top soil by grass is noticeable and may be contrasted with the very small drying out at 12 in. in the cultivated orchard. Water applied to the surface of a soil block is found to wet it thoroughly to a limited depth, depending on the amount of the water. Further movement of this water to drier regions is very slow. Trees with roots in the different layers at 36 in. and 12 in. continued to draw water from both layers although the pull in those layers differed greatly.

580. ROGERS, W. S. AND SRIVASTAVA, D. N. 631.432 : 634.13

**Soil moisture studies. II. Moisture variation in a pear orchard.**

*Annu. Rep. East Malling Res. Sta. for 1936, A20, 1937, pp. 110-3, bibl. 2.*

Records were taken in porous pot meters 18 in. deep by the side of two 16-year-old pear trees from April onwards. There was no moisture deficiency during the blossom period. The June drop coincided with the beginning of a slight drying out process in the soil, which could not, however, in any way be considered as signifying drought conditions. Both trees were Doyenne du Comice on quince A, but one was considerably larger than the other, and it was found that the soil round the larger tree dried more rapidly and became resaturated more slowly than that round the smaller tree.

581. WIGGANS, C. C. 634.11-1.432

**Some further observations on the depletion of subsoil moisture by apple trees.**

*Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 160-3, bibl. 1.*

The conclusion was drawn in an earlier paper (*Ibidem* 33 : 103-7, *H.A.*, 1936, 6 : 689) that in areas deficient in rainfall, such as Nebraska, fruit trees may deplete the subsoil of moisture to very considerable depths. Further soil moisture samples taken in 1935 and 1936 to depths of 40 feet or more in an 18-year-old Delicious apple orchard growing in a deep, porous, loess soil confirm this conclusion. By taking samples approximately 1 year apart it was shown that the greatest depletion occurred directly under the tree and below the 16-foot level. The rainfall in the area was less than 24 in. during this period, whereas between 31 and 35 in. of water were removed by the trees, a mixed cover crop and direct evaporation. If this loss of 9 to 10 in. were repeated in each of the next 3 years all available water in the soil would be removed to a depth of 30 feet. Moreover, even this estimate may be too generous, since there is some evidence that apple trees can remove only about 90% of the calculated available water (hygroscopic coefficient  $\times 1.5$ ) from soils of this type.

582. BOYNTON, D. 634.11-1.432

**Soil moisture and fruit growth in an orchard situated on shallow soil in the Hudson Valley, N.Y., 1936.**

*Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 169-72, bibl. 6.*

Soil moisture samples were taken at fortnightly intervals during the period May to August inclusive in 2 plots in a 12-year-old McIntosh orchard situated on a gravelly loam soil. In plot 1 there were 24 in. of soil overlying rock and in plot 2 42 to over 48 in. Fruit circumference measurements were taken at fortnightly intervals from 15 June onwards. From 5 May to 30 June the moisture percentage remained well above the permanent wilting point of sunflowers at all depths in both plots. During the succeeding fortnight lack of rain and a high rate of evaporation produced in plot 1 a decline in the soil moisture percentage from about 35% of the available capacity to the wilting percentage, and this resulted in a reduction in the rate of fruit growth. In plot 2 soil moisture also declined markedly, but the wilting point was not reached in any layer, and there was no decline in the rate of fruit growth. During the remainder of the season soil moisture did not fall again to the wilting point in either plot and fruit growth in both plots proceeded at a normal rate. The difference in size of the fruits from plots 1 and 2, which was established during the fortnight 30 June-13 July was, however, maintained to the end of the season.

*Manuring,\* Cultural Practice.*

583. BABCOCK, W. G. AND OTHERS. 631.67 : 631.84  
**Suitability of nitrogenous fertilizers for application in irrigation water.**  
*Fruit Culture and Small Fmg. (Sydney), 1937, 7 : 80 : 6-7, 15.*  
Summer applications in irrigation water of quickly available nitrogen provide nitrogen economically and efficiently at the most needed time and in such concentrations as are thought desirable. Calcium nitrate, ammonium sulphate and anhydrous ammonia can be so used, the former affording an immediate supply of nitrate nitrogen and uniform distribution throughout the root zone of the soil. The ammonium compounds require time for conversion into nitrate form and are not subject to a uniform distribution throughout the root zone. Calcium nitrate and ammonium sulphate are not subject to loss through evaporation but, when anhydrous ammonia is so used, varying amounts are lost in the atmosphere through evaporation.
584. SMITH, G. E. 634.11-1.84  
**Nitrogen content and growth response from fall and spring fertilizer applications to apple trees.**  
*Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 133-6, bibl. 5.*  
15-year-old Golden Delicious and Gano trees growing in Missouri in heavy bluegrass sod on loess soil were each given 1 lb. nitrogen in the form of sodium nitrate, ammonium sulphate or calcium cyanamide. The applications were made either in the autumn (15 September-1 October), the early winter (after 1 November) or in the early or late spring of the two seasons 1934-35 and 1935-36. Check trees in both years received no nitrogen. The results as estimated by shoot growth measurements and by determinations of the percentage nitrogen in dried twig leaves, blossoms and fruits indicate that the autumn and early winter applications were as effective, if not more effective, than the spring applications. Calcium cyanamide produced no injurious effects and under conditions of adequate moisture resulted in growth which compared favourably with that produced by the other nitrogenous fertilizers. In both seasons the early winter applications of cyanamide produced greater growth than the other applications of this fertilizer. It is concluded that in Missouri, where spring moisture conditions are very variable, nitrogen might with advantage be applied in the autumn or early winter rather than in the spring, and that in the case of cyanamide it would seem to be important to make the applications during rainy periods or to work the fertilizer into the soil.
585. MARSH, R. S. 634.11-1.84  
**A summary of some tests with different kinds of commercial nitrogenous fertilizers applied to apple trees.**  
*Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 145-8, bibl. 3.*  
Nitrogen fertilizer trials were carried out from 1926 to 1934 in a mature Winesap orchard in Calhoun county, Illinois, and thereafter at Urbana. Certain of the results have been published in earlier papers, the most recent of them being that noted in *H.A., 1936, 6 : 693*. In the present paper unpublished data from both localities are discussed and the two phases of the work are summarized. In general the results appear to indicate that under the conditions of the trials calcium cyanamide possessed no advantages over sulphate of ammonia or nitrate of soda. Cyanamide produced higher soil nitrates in the late autumn and early spring than the other fertilizers, but this was not reflected in any apparent improvement in growth or foliage conditions, and in the Calhoun county trial total yields in the cyanamide plots were consistently lower than in the other plots. Analyses for total nitrogen in bearing spurs over a 5-year period have shown that calcium cyanamide apparently possesses sufficient "carry over" effect to mask any difference in availability between it and the other types of fertilizer. Finally tests for soil nitrates in 1936 have confirmed the earlier conclusion, that, under conditions of clean cultivation and average fertility, drought may give rise to an increased soil nitrate nitrogen content.

\* See also 601-621, 796.

586. [ESBJERG, N.] 634.11-1.542

Forsøg med Beskaering af Aebletraeer. (*Pruning of apple trees.*)

*Tidsskr. Planteavl.*, 1936, 41 : 650-4, being *Meddelelse 241.*

The effect of pruning young trees is shown in crop figures for the years 1919-1934. Pruning resulted in a loss of 17-33% in weight of crop, depending on the variety, but also in a 10-16% increase in fruit size. Twelve varieties on the different stocks were planted in 1920, cut back at planting and then left unpruned. The plantation was divided into 6 equal plots and of these three have been pruned since the spring of 1932 and three left unpruned. Comparative crop figures for 1933 and 1934 are as follows:—Trees on crab stock: No pruning 100, No pruning 1920-31 and pruned from 1932 87; trees on East Malling Type V stock: 100 and 94; trees on East Malling Type IV stock: 100 and 94, and size of fruit, average of 3 stocks, 100 and 111 respectively.

N.E.

587. KNOWLTON, H. E. 634.11-1.542.27

**The effect of time of thinning on apple size.**

*Proc. Amer. Soc. hort. Sci. for 1936*, 1937, 34 : 116-9, bibl. 2.

The effect of the time of thinning on apple size was studied in West Virginia in the 3 years 1931-33 using one or more of the following varieties in each year: Oldenburg, Golden Delicious, Delicious, Grimes and Wealthy. The trees were thinned at different times from June to the end of August, and check trees were left unthinned. The results, as opposed to those obtained previously with peaches, indicate that the earlier the thinning the larger will be the size of the fruit at harvest time. Since studies made elsewhere have also shown that early thinning may promote annual cropping in varieties which normally bear biennially, it would seem desirable, from a practical standpoint, to thin these varieties early and leave the thinning of the other varieties until later as time allows. The important advantages of late thinning, especially in areas subject to mid-summer hail storms, and the possibility that early thinning may result in oversized apples should not, however, be forgotten.

588. BLAKE, M. A. AND DAVIDSON, O. W. 634.25 : 581.145.2

**Some studies of the degree of maturity of peaches at harvest in relation to flesh firmness, keeping quality, and edible texture.**

*Bull. N. J. agric. Exp. Sta.* 606, 1936, pp. 35, bibl. 9.

*Stages in the development of peach fruits.* As a result of studies made in 1929 and 1930 on Alberta 4 stages in the development of peach fruits were distinguished: 1. A cell division stage extending from blossom fertilization to pit hardening. 2. A cell wall thickening stage extending (in New Brunswick) from about mid-June to mid-July, during which time the cell walls of the flesh thicken and the pits harden. 3. The pre-ripe stage, during which the cells of the fruits enlarge slowly and the cell walls decrease very gradually in thickness. 4. A flesh-ripening stage which in New Brunswick extends over a period of 2 weeks or less, when the fruits grow and soften rapidly and become fully mature. *Effect of carbohydrate nitrogen status of the trees on sugar and acid concentrations in the fruit.* Detailed chemical studies were also made in 1930 on Alberta peaches picked during the ripening stage from trees of high carbohydrate (H.C.), medium-high carbohydrate (M.C.) and high nitrogen (H.N.) growth status. Fruits from the H.C. and M.C. trees were always found to contain 30-75% more reducing sugars than did fruits from the H.N. trees. Similarly, sucrose concentrations were higher and acid concentrations lower in fruit from the H.C. and M.C. trees than in fruits from the H.N. trees. These differences in sucrose and acid concentrations became insignificant, however, when the fruit was picked at the soft-ripe stage, except in the case of fruits from the interior of the H.N. trees, which were always distinctly lower in sucrose and higher in acid than were the other fruits examined. *Changes in peach fruits stored at room temperatures.* Alberta fruits held at room temperature for 11 days decreased in volume by as much as 22% and in weight by over 15%. Pressure tests made on the fruits indicate that peaches picked sufficiently mature to possess good edible quality soften considerably during 3 days in storage. On the other hand, since peaches contain only very small amounts of reserve foods from which sugars and acids may be formed, they do not ripen

or improve in flavour after picking. *General conclusions from the studies with Elberta.* The results of the studies are held to indicate that, under New Brunswick conditions, peaches having an acid concentration above 15 (10 c.c. of juice requiring more than 15 c.c. of  $\frac{N}{10}$  alkali for neutralization) together with a total sugar concentration of less than 7% are distinctly sour and immature in taste and flavour. Trees with an excessive nitrogen : carbohydrate ratio produce fruits deficient in red colour, possessing maximum pubescence, ripening unevenly, abnormally low in sugars, and, when picked early for long distance transport, abnormally high in acids and low in eating quality. *Pressure tests as an index of flesh firmness and maturity.* Studies with Chinese Cling, J. H. Hale and two unnamed varieties indicate that pressure tests provide a reasonably accurate means of determining keeping qualities and rates of softening in peach fruits, and it is considered that flesh firmness tests should be used to supplement colour guides as the basis for judging ripeness. At present there appears to be no other reasonably accurate way in which two samples of peaches of the same stage of maturity can be selected from two trees possessing markedly different nutrient statuses. Standards, based on pressure tests, are suggested and defined as guides for the harvesting and sale of peaches.

### SMALL FRUITS, VINES, NUTS.

589. [CHRISTENSEN, E.] 634.725  
*Forsøg med Stikkelsbaersorter. (Gooseberry variety trials.)*  
*Tidsskr. Planteavl.* 1936, 41 : 657-9, being *Meddelelse* 243.  
 Gooseberry varieties, 8 with white or green fruits and 16 with yellow or red fruits, were tested between 1925 and 1934 at Spangsbjerg (good, sandy soil) and Blangsted (heavy soil) in 6 duplicate plots, each plot containing 8 bushes. Average annual yields given in tons per ha. were as follows:—Riesen von Coethen 7·9, Whitesmith 6·3, Früheste von Neuwied 1·8, Red Jacket, Triumphant (yellow), Achilles, Walhalla and Whinhams Industry from 7·4 down to 5·7 and Dans Mistake 2·0.  
 N.E.
590. SWARBRICK, T. AND BERRY, W. E. 634.723-1.542  
*Comparative yields of black currant varieties and their response to differential pruning treatment.*  
*Annu. Rep. Long Ashton Res. Sta. for 1936*, 1937, pp. 66-74.  
 Preliminary results of these trials were published in the Annual Reports for 1931 and 1934 and concerned the incidence of reversion, the control of big bud, and the comparative costs of picking the several varieties. The present paper gives a final report on the cropping of the 6 varieties and on the effect of hard and light pruning on the yields for the 7-year period 1930-36. Boskoop, Baldwin French and Edina cropped satisfactorily, but Davidson's Eight and Taylor were not so good. The yields are examined statistically. A comparison of pruning methods on the first four varieties showed that hard pruning reduced the crop significantly in all cases. The importance of the results to commercial practice and the reduction of crops by reversion are discussed.
591. WARE, G. W. 635.611 : 631.544.1  
*Plant protectors and other factors influencing earliness and production of cantaloupes.*  
*Bull. Ark. agric. Exp. Sta.* 324, 1936, pp. 48, bibl. 12.  
 The trials described here were carried out under the comparatively mild conditions of southern Arkansas in the three years 1933-35. The main comparisons were between plants raised under 5 different types of protector and plants grown without any protection, and between sowing in the open on 10 April and sowing in a greenhouse and subsequently transplanting to the field on 10 April. Other sowing dates in the open were also tried. The five protectors tested were (1) The standard wax-treated hot-kap, (2) a 10×6 in. black screen wire cone (screens), (3) a corrugated glassene, wire supported cap (glassene), (4) a celoglass cylinder with an 8-in. diameter

glassene top (celoglass), and (5) a continuous paper greenhouse on hoops. Temperatures and light intensities were recorded under the various protectors. With seed sown in the field all the protectors hastened germination by 1 to 5 days by comparison with no protection. The protectors also afforded protection from rodents, insects and unfavourable weather conditions and produced final stands of 89 to 91% compared with a stand of 84% for the uncovered plants. Plants under some of the protectors suffered a slight temporary check when the protectors were removed, but, in all normal cases, they exhibited marked ability to adjust themselves rapidly to the new environment. The early advantages in plant development tended to disappear as the season advanced. The date of first bloom was hastened by 3 days by the continuous paper greenhouse and 2 days by hot-kap and glassene. The plants raised in the field for the most part gave as high or higher yields than comparable transplanted plants. The one notable exception was the series of transplants under the continuous paper greenhouse which produced more early marketable, total marketable and total melons per acre than did any other treatment. With the plants sown or transplanted on 10 April considered collectively, the yields, especially of early marketable melons, were much higher in the hot-kap, glassene, continuous paper greenhouse and screen plots, in the order named, than in the comparable unprotected plots, while the celoglass treatment gave yields inferior to no protection. Sowing on 10 April resulted in higher yields of early and total marketable melons than did sowing on earlier or later dates, and with each different sowing date hot-kap protectors produced higher yields than no protection. The average cost of protection ranged from \$7.56 for screens to \$39.85 for celoglass. The results of the present investigations appear to indicate that the use of the better types of protector for cantaloupes would be justified in cases where a premium for earliness is assured.

592. HUGO, F. C. 634.8  
**Cultivation of vineyards along the Orange River.**  
*Fmg S. Afr., 1937, 12 : 275-6.*  
 Instructions are given for cultivating the sultana vine, with special reference to the methods followed along the Orange River from Buchuberg to below Kakamas.
593. THOMAS, J. E. AND BARNARD, C. 634.8-1.542  
**The influence of tipping, topping, cincturing and disbudding on growth and yield in the sultana vine.**  
*J. Coun. sci. industr. Res. Aust., 1937, 10 : 64-78, bibl. 5.*  
 Experimental summer treatments of tipping, topping, disbudding and cincturing have been carried out at Mildura for several seasons on mature vines on their own roots. The effect of tipping or topping is slightly to increase yield the first season in vigorous vines; the second season showed a marked increase in yield of fresh fruit, but this was offset to some extent by a drop in sugar content. During subsequent seasons there has been a decrease of vegetative vigour and in starch accumulation and a decline in yield of fresh and dried fruit. Tipping is detrimental to vines of low vigour and undesirable even for the most vigorous. Cincturing either at setting time or later lowered both the yield and sugar content of the fruit during the second and subsequent seasons, although a slight increase of yield (with, however, a depressed sugar content) was shown during the first season. Early disbudding influenced neither growth nor yield, late disbudding resulted in a reduction of yield. Disbudding is, therefore, both unnecessary and undesirable.

594. OINOUE, Y. 634.8 : 581.144.1  
**Effet de l'eau lourde pour la débourrement de la vigne. (Effect of heavy water on bud-break in the vine.)** [Japanese, French summary.]  
 Reprint from *J. hort. Ass. Japan*, 1936, 7 : 207-8, bibl. 4.

The author placed 5 1-year-old vine shoots of the variety Prentiss (*Vitis labrusca* L.) in 50% heavy water, and compared their dates of bud-break with those of control cuttings. Under conditions existing in a cold greenhouse bud-break in the control plants started on 5 March, whereas growth did not start in the treated shoots until 20 April. A microscopic investigation

has shown that distinct biochemical differences existed between the treated and control plants. In the latter, reduction of the carbohydrates and the combination of these with organic nitrogen compounds was completed by 28 February, whereas in the shoots treated with heavy water the reduction of carbohydrates was almost entirely prevented until the beginning of April. [Author's summary.]

595. WALTERS, D. V. 634.873 : 664.85.047  
**Investigations of local problems related to dried fruits production in the Nyah-Woorinen Districts.**

*J. Coun. sci. industr. Res. Aust.*, 1937, 10 : 107-22.

An account is given of the organization of and the investigations carried out by an Enquiry Committee in the Nyah-Woorinen irrigation settlements in Victoria, Australia, on the yield and quality of the locally produced dried fruits. The growth and maturity of the vine were studied and the former was found to be similar to that in other Murray valley districts but with a lag of ten days. Soil type was not a dominant factor in yield. It was found that district practice could be improved by a restriction of bearing wood and that the size and degree of growth of the bunches was related to the development of shoots on which the bunches were borne. With Zante currants the removal of weakly shoots early in spring produced an improvement in quality.

596. THOMAS, J. E. AND BARNARD, C. 634.8-1.547.4/5  
**Fruit bud studies. III\*. The sultana : some relations between shoot growth, chemical composition, fruit bud formation and yield.**

*J. Coun. sci. industr. Res. Aust.*, 1937, 10 : 143-57, bibl. 15.

At Merbein, Victoria, in blocks of vines of average or sub-average vigour the most vigorous vines produced the most fruit but in blocks of vigorous vines no correlation was found between vegetative vigour and yield of individual vines. If excessive shoot growth tended to reduce the number of fruitful buds this was compensated by the larger size of the bunches. To increase yield capacity vegetative growth might be stimulated in those blocks of vines showing a positive correlation between vigour and yield of individual vines, and where a negative or no correlation is found the same effect might be produced by pruning more in accordance with individual vigour and by leaving more bearing canes per vine. An examination of the morphological characteristics of the pruning cane showed bud fertility to be positively associated with diameter and weight of cane, but not with mean internode length. The percentage of starch in the annual wood is closely associated with fruit bud formation and the accumulation of reserve starch and the proper ripening of the next season's fruiting shoots is greatly assisted by uninterrupted growth from September to February. This continuance of growth is all the more necessary, if a heavy current season's crop is on the vines.

597. SCHUSTER, C. E. 634.54-1.557 : 581.143  
**Relation of shoot growth to setting and weight of fruit in the filbert.**

*Proc. Amer. Soc. hort. Sci. for 1936*, 1937, 34 : 62-5, bibl. 1.

Data are presented which indicate that :—(1) In naturally grown or unpruned filbert trees a large proportion of the new shoot growth made each year is not only unproductive but relatively short-lived. (2) Nuts borne singly are much heavier than those borne in clusters of 5 or 6, although the total weight of fruit produced is greater when several nuts are borne in a cluster. (3) Long secondary shoots produce a larger number of nuts per cluster than short shoots, and among clusters containing equal numbers of nuts those borne on long shoots consist of heavier nuts than do those on short shoots. (4) In the trees in question the shortest shoots bore 20% of their nuts singly and the longest shoots only 2.2%. (5) The longer primary shoots produce more buds that set a higher percentage of fruit clusters than do short shoots; the longer secondary shoots bear larger nuts and more of them in a cluster, which results in an increased total

\* Parts I and II. *Ibidem*, 1932, 5 : 47-52 and 1933, 6 : 285-94, *H.A.*, 1932, 2 : 152 and 1934, 4 : 204.

weight per shoot. (6) Records taken in a second orchard show that, although the same general relationships hold good, a certain length of shoot and number of nuts in a cluster does not necessarily give the same average weight per nut in different orchards.

598. PEEBLES, R. H. AND HOPE, C. 634.574 : 581.162.3

**The influence of different pollens on the development of pistache nuts.**

*Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 29-32, bibl. 1.*

Experiments made in Arizona during 1933 indicate that the fruit of the pistache is influenced by the kind of pollen used. *Pistacia vera*, varieties Trabonella and Red Aleppo, was used in the pistillate parent, and *P. atlantica*, *P. chinensis* and a hybrid of unknown origin were employed as the staminate parents. The three characters affected by the different pollens were date of maturation and, less definitely, the proportion of self-splitting nuts and the length of the pericarp. It is not yet clear, however, whether the variation in these characters might be regarded as metaxenia or whether the differences were due to delayed fertilization and would therefore be physiological. Repetition of these tests in subsequent years has been prevented by unfavourable seasonal conditions.

599. VAN HORN, C. W. 634.521-1.557-1.51

**Notes on the effects of soil management on the growth in diameter of pecan nuts.**

*Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 67-73, bibl. 6.*

Burkett pecan trees planted in 1931 at Yuma, Arizona, were subjected to 5 treatments, involving different frequencies of irrigation, cover crops and manuring, in 1935 and 1936. Tree responses and the growth in diameter of the nuts during 1936 are noted. Up to the present, however, the only conclusion that can be drawn is that soil moisture alone does not govern the growth in diameter of the nuts.

600. FINCH, A. H. 634.521 : 581.192

**The use of ethylene to improve pecan harvesting.**

*Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 74-7, bibl. 3.*

Failure of pecan nuts to mature satisfactorily, as manifested by faulty or delayed separation of the shuck from the shell and subsequent dehiscence of the shuck, is an important problem in Arizona, since it delays harvest, increases the cost of gathering and preparing the nuts and contributes to a serious amount of pre-harvest germination. Preliminary studies in 1935 and 1936 have shown that, when nuts of various varieties were picked during the harvest period and subjected to an atmosphere containing ethylene of an approximate concentration of 1 in 1,000, the shucks were invariably loosened and could be removed after 24-48 hours. The treatment did not, however, produce the brown colour typical of well matured shells, but it was found that this could be obtained by drying the nuts in their shucks after treatment. Studies are now to be made to determine a satisfactory index of maturity, whereby nuts with closed shucks may be harvested at the stage of optimum quality.

### PLANT PROTECTION OF DECIDUOUS FRUITS.

601. ROACH, W. A. 581.111 : 634.11-2.19

**The injection of single interveinal areas of leaves for diagnosis of mineral deficiency.**

*Annu. Rep. East Malling Res. Sta. for 1936, A20, 1937, pp. 142-5, bibl. 1.*

The author describes in detail and with illustrations his technique for the injection of fluid into the interveinal areas of apple leaves or leaves of similar size. Notes are given of the distribution of the nutrient solution after injection. This varies according to the duration of the injection. For the detection of mineral deficiency 7 hours has been found suitable for apple trees. Iron shortage was thus diagnosed in 3 days, at the end of which time the injected area was perceptibly greener than the areas on either side.

602. ROACH, W. A. 581.111 : 634.11-2.191

**Iron "shortage" chlorosis in apple trees grown in water culture\*.**

*Annu. Rep. East Malling Res. Sta. for 1936, A20, 1937, pp. 146-9, bibl. 3.*

The cause of a chlorosis in apple trees grown in a culture solution containing 10 p.p.m. ferric citrate was found by interveinal injection (see abstract 601) to be due to faulty iron metabolism. It was found possible to restore the foliage and keep it at its proper colour by the administration once a fortnight of a solution containing 100 p.p.m. ferric citrate. The author suggests that a simpler and probably equally effective method would be to omit the phosphate from the solution when changing the solutions and to add it one day later when the trees have had time to absorb their iron requirements until the next renewal of the solution.

603. ROACH, W. A. 581.111 : 634.1/2-2.19

**Leaf stalk injection for the diagnosis of mineral deficiency.**

*Annu. Rep. East Malling Res. Sta. for 1936, A20, 1937, pp. 150-2.*

The technique of leaf stalk injection is described in detail. The author also describes the subsequent permeation of neighbouring leaves by the injected liquid. In certain leaves the blade on one side of the main vein is permeated, the corresponding area on the other side being unaffected. Rapid diagnosis of iron shortage in apple trees in the plantation has been carried out by injecting iron salts and comparing the affected and unaffected areas. Such diagnosis should, it is thought, be applicable to other mineral deficiency symptoms.

604. ROACH, W. A. AND LEVY, B. F. G. 581.111 : 634.1/2-2.191

**Iron shortage chlorosis in the plantation. A progress report.**

*Annu. Rep. East Malling Res. Sta. for 1936, A20, 1937, pp. 153-9, bibl. 5.*

A chlorosis of the iron shortage type is common in the calcareous soils of Kent. Instances are given from Swanley (peaches), Sittingbourne (cherries) and East Malling (largely experimental). The symptoms are a light green colour of the foliage indistinguishable at sight from that of nitrogen shortage. They were here proved to be those of iron shortage by injection experiments. Various preliminary attempts to cure the trouble included application of iron salts (ferric citrate and ferrous sulphate) to the soil, injection of iron salts solid and in solution into the trees, driving in iron nails, grassing down, breaking down the turf in cherry orchards, and the application of various forms of organic matter to the soil. None of the above treatments offers a complete cure in one year, but some of them do offer hope of a gradual cure in the course of a few years.

605. ROACH, W. A. 581.111 : 634.1/2

**The injection of individual branches of a tree independently of each other.**

*Annu. Rep. East Malling Res. Sta. for 1936, A20, 1937, pp. 160-6.*

The author gives a full illustrated account of the method used by him when injecting individual branches of the same tree. The chief apparatus found necessary and used by him were:—a milk carton, rubber tubing 2 mm. in external diameter, and solution, pads of rubber sheeting  $1\frac{1}{2} \times 1$  in. and  $\frac{1}{2}$  in. thick, glass or stainless steel tubing  $\frac{5}{8}$  in. long and 2 mm. in diameter, a piece of glass rod or wire nail, a rubber binding strip 10 in.  $\times \frac{3}{4}$  in. (an old bicycle inner tube will do), a set of metal drills  $\frac{1}{16}$ ,  $\frac{1}{8}$ ,  $\frac{3}{16}$  and  $\frac{1}{4}$  in. in diameter, a set of steel cork borers, a set of metal rods sharpened into a chisel at one end, a set of metal rods each of which fits inside a cork borer and has a drill of about  $\frac{1}{2}$  of its diameter soldered concentrically into its one end, a pad of nearly pure white rubber about  $2 \times 2 \times \frac{1}{2}$  in. The author describes how the position of the hole must be determined. He considers that before nutrients are injected preliminary trials with dyes such as light green, patent blue and acid fuchsin should be made to ascertain the probable extent of downward penetration in the particular material under experiment. The hole must be as small as possible, the cambium at each end should be damaged as little as possible, and the hole through the wood should be clearly made with a sharp drill. The author summarizes as follows:—Selected branches of a single tree may be injected independently each with a different solution. The injected liquid is absorbed through a hole bored diametrically through the branch at a point

\* See Abstract 566.

three-quarters the distance from the branch-tip to the limit within which it is desired to confine the permeation. The liquid held in a reservoir is led through rubber tubing to the hole, a watertight joint being made between them. The branches are not damaged appreciably by the operation if it is carried out properly.

606. SRIVASTAVA, D. N. AND ROACH, W. A. 581.111 : 634.13  
**The injection of individual branches of a spur-pruned pear tree. A progress report.**  
*Annu. Rep. East Malling Res. Sta. for 1936, A20, 1937, pp. 167-70, bibl. 2.*  
 The results of preliminary experiments suggest that the physiological effects of injections made at suitable points in branches are confined to the branches. They prove that the branches for experiment must be selected with great care so that all arise at closely similar positions on the main crutch, especially in trees which tend to produce one vigorous leader branch. Unequal fruit drop on treated and untreated branches must be avoided. [Authors' summary.]
607. SEN, P. K. 581.111 : 634.11  
**The injection of individual branches of a tree which has not been spur-pruned. A progress report.**  
*Annu. Rep. East Malling Res. Sta. for 1936, A20, 1937, pp. 171-3, bibl. 2.*  
 Fifty-four branches of apple trees which had not been spur-pruned were injected with solutions of nutrient substances. All except one of these solutions remained in the injected branch. Urea caused a big increase in shoot growth (in the "off" year trees) and there were smaller increases resulting from the injection of urea plus potassium salts in both "on" and "off" year trees. Glucose caused a decrease of shoot growth. The toxic effect of "urea phosphate" was more severe on the branches of the "on" year trees than on those of the "off" year trees. These results encourage the hope that branch injection may become a useful method in physiological experiments. [Author's summary.]
608. ROACH, W. A. 581.111 : 634.1/2  
**The injection of whole trees.**  
*Annu. Rep. East Malling Res. Sta. for 1936, A20, 1937, pp. 174-9, bibl. 1.*  
 The author describes in considerable detail the procedure which he has found most satisfactory for the injection of whole trees. He notes the difficulties in injection which arise as the result of different pruning systems and states the principles which should guide the experimenter, noting however, in other words, that a little experience is better than a mire of reading. Practical details are given on the placing of the injection points in relation to the branches and the drilling of the holes.
609. HILL, H. 634.11-2.19  
**Functional disorders of apples on the tree.**  
*Annu. Rep. East Malling Res. Sta. for 1936, A20, 1937, pp. 180-2.*  
 The author gives brief notes differentiating, from observations made in Canada, between drought spot = superficial cork, internal cork, water core and bitter pit = tree pit, all being disorders found on apples still on the tree. Distinction is made between drought spot and internal cork which are associated with a deficiency and can be cured by boron applications, and water core and bitter pit for which no satisfactory remedies have as yet been found.
610. LEVY, B. F. G. AND ROACH, W. A. 581.111 : 634.11-2.19  
**Preliminary injection experiments on bitter pit in apples.**  
*Annu. Rep. East Malling Res. Sta. for 1936, A20, 1937, pp. 183-4.*  
 Sixteen 14-year-old trees of Northern Spy on rootstock IX, which had previously borne small crops affected with bitter pit when on the tree, were used for whole tree injection experiments, boric acid alone (0.1% solution), boric acid + complete nutrient solution, complete nutrient solution, and nil being the treatments. No treatment markedly affected vigour or reduced bitter pit.

611. HULME, A. C. AND OTHERS. 581.111 : 634.11 + 664.85.11  
**A tree injection experiment on the keeping quality of apples. A progress report.**  
*Annu. Rep. East Malling Res. Sta. for 1936*, A20, 1937, pp. 185-6, bibl. 2.  
 Twenty-three-year-old bush-trained Bramley's Seedling apple trees were injected by the whole tree method with one of the following solutions:—0·5% sodium phosphate, 0·5% urea, and 0·5% sodium phosphate + 0·5% urea, two trees being treated with each solution and two trees left untreated. The figures showing the respiration rates of apples borne by these trees are graphed. The authors reach the two tentative conclusions that possibly tree injection may be used as a method for investigating keeping quality in fruit and that possibly the bad effect of high nitrogen content may be counteracted by increasing the phosphorus content.
612. VAN HAARLEM, J. R. 634.1/7-2.19-1.8  
**Some results of mineral deficiency studies.**  
*Publ. Vineland hort. Exp. Sta., Ont.*, undated,\* pp. 10.  
 A general account is given of studies of mineral deficiencies in tree and small fruits carried out at Ottawa and in the Niagara district. The soils in the area are roughly classified according to their supplies of available phosphorus and potassium. Brief descriptions are given of the symptoms of potash deficiency observed in apples, pears, peaches, raspberries, strawberries, grapes (suspected only), tomatoes and chrysanthemums; of phosphorus deficiency in apples, peaches and strawberries; of boron deficiency in turnips, with a note on experiments in which boron injections effected a cure of drought-spot, corky-core and die-back of apple trees; and of iron deficiency or lime-induced chlorosis in plums, raspberries and grapes. As a result of field observations and of a manurial experiment carried out on a block of peaches at Vineland (apparently on a light sandy soil commonly deficient in both P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O—ED.), growers are recommended, where possible, to apply some manure to their trees and to supplement this with dressings of superphosphate and potash. Annual cover cropping would also appear to be a good practice on soils likely to suffer from mineral deficiencies.
613. SHAW, C. W. 634.25-2.19-1.8  
**Report of a fertility survey of Niagara Peninsula peach soils.**  
*Publ. Vineland hort. Exp. Sta., Ont.*, undated,† pp. 4.  
 Soil samples were taken at various depths to 3½ ft. from over 200 farms in the Niagara peach area, and recently adopted rapid chemical methods were employed to determine the amounts of readily available N, P and K. Some of the conclusions drawn from this survey and the foliage symptoms found to be associated with a deficiency of any of the three elements are noted briefly. Nitrogen deficiency is shown first by yellowing of the leaves, particularly along the margins; the yellow areas turn a pinkish colour and later develop into reddish spots; and the discoloured areas finally drop out. Premature defoliation is also characteristic. With phosphorus deficiency the leaves usually turn a yellowish colour along the midribs, while potassium deficiency is shown by scorching of the leaf margins which drop out in the later stages so that in severe cases practically none of the leaf, except the midrib, remains. Suggestions are made of various methods for supplying the elements which are deficient.
614. SMOCK, R. M. 634.11-2.19 : 551.52  
**Bitter pit of Gravenstein apples. I. The effect of environmental temperature during the growing period.**  
*Proc. Amer. Soc. hort. Sci. for 1936*, 1937, 34 : 179-186, bibl. 14.  
 Four large branches on a 14-year-old Gravenstein apple tree growing in Central California were subjected to the following treatments in May and June:—(1) 1 branch enclosed in a celo-glass chamber and heated during the night, the sides of the chamber being removed during the day;

\* Received June 1937.

† Probably January 1937.

(2) 1 branch enclosed in an insulated chamber kept cool by means of ice; (3) 1 branch left as a control; and (4) 1 branch enclosed day and night in a celo-glass chamber and thus subjected to marked decimal fluctuations in environment with very high day temperatures. Only the effects of the first three treatments are considered here. Records taken at weekly intervals showed that the treatments affected not only the temperature, but the humidity and light intensity of the environment. These differences were in turn reflected in differences in growth rates, maturity and sugar contents of the fruits, but there were no significant differences in the amount of bitter pit between treatments nor between exposed and unexposed sides of the fruit. It is pointed out, however, that these results do not exclude the possibility that, had whole trees been subjected to the treatments, environmental conditions might have been found to exert an indirect influence on bitter pit through affecting metabolic conditions within the tree. Finally, mention is made of a second experiment, in which boric acid, injected into the roots of a 10-year-old Gravenstein tree, failed to reduce the amount of bitter pit by comparison with adjacent untreated trees.

615. [ESBJERG, N.] 634.11-2.19 : 664.85.11  
 "Priksgyge" paa Aebler. (**Bitter pit in apples.**)  
*Tidsskr. Planteavl.*, 1935, 40 : 644-6, being *Meddelelse* 226.  
 Apples from experimental plots at Blangsted stored till ripe for eating were sorted for quality and disease. The incidence of bitter pit following different cultural conditions is noted. *Influence of manuring.* The largest percentage of bitter pit was noticeable (on the average of 7 varieties in 1932 and 1933) in apples from trees which had received full organic manuring and was followed by those from trees which had received a complete artificial fertilizer application. *Pruning.* Results based on 864 trees (8 varieties) showed 8.1% bitter pit incidence after no pruning and 10.4% after light pruning. *Varietal susceptibility.* This varied in 1933 from 0 to 27.9%. *Influence of cold storage.* Bellefleur de France showed 32% bitter pit after common storage from 16 September to 27 October and after cold storage (about 1.5° C.) from 18 September to 4 January only 9% bitter pit. N.E.

616. PIPER, C. S. 634.11-2.19 : 546.27  
 The boron status of South Australian apples.  
*J. Coun. sci. industr. Res. Aust.*, 1936, 9 : 245-8, bibl. 7.  
 The boron contents of 48 samples of apples from the more important apple-growing districts of South Australia have been determined. The values obtained ranged from 12-30 parts of boron per million parts of dry matter, and, by comparison with New Zealand standards, it is concluded that boron deficiency is not likely to be found in the districts examined. [Author's summary.]

617. BURRELL, A. B. 634.11-2.19 : 546.27  
 Boron treatment for a physiogenic apple disease.  
*Proc. Amer. Soc. hort. Sci. for 1936*, 1937, 34 : 199-205, bibl. 15.  
 Evidence is presented to show that the drouth spot, internal cork, rosette and die-back disorders of apple trees and fruits, which are a serious problem in the Lake Champlain Valley of New York State, are probably different symptoms of the same disease rather than separate diseases. Earlier experiments started in 1926 with soil applications of boron produced inconclusive results, either because the check trees failed to develop the disorder or because the check trees recovered as rapidly as the treated trees, owing, it is thought, to a succession of rainy seasons. Experiments with boron and other chemicals were resumed in 1936. In a block of 4- to 6-year-old Fameuse and McIntosh trees, badly affected by rosette and "incipient die-back", 1 to 2 grams of boric acid crystals, applied in a hole  $\frac{7}{16}$  in. in diameter and 2 in. deep, produced a cure, whereas untreated trees and trees injected with zinc sulphate remained diseased. No foliage injury followed the injection of dry boric acid crystals, but killing of the cambium and bark for a fraction of an inch laterally and a somewhat greater distance vertically was general. Injuries from boron applied to the soil or injected as a solution in excessive quantities are also described.

618. JAMALAINEN, E. A. 634.11-2.19 : 546.27  
 Boorin vaikutus kuoppataudin esiintymiseen omenissa. (The effect of boron on the occurrence of cork disease in apples.) [Finnish, English summary, 5pp.]  
*Valt. Maatalousk. Julk.* 89, 1936, pp. 19.

Certain points of similarity between the cork disease of apples (known elsewhere as crinkle, corky pit, internal cork, York spot, etc.) and heart rot of beet and brown heart of rutabaga suggested that boron, which controlled the latter disorders, might also control cork. In 1935 20 g. boric acid were applied to the soil around each of 4 trees which had previously been badly affected by the disorder. In three of the trees no beneficial effect was observed, but in the fourth the percentage of affected apples was reduced from 100 to 15. Subsequently the author became acquainted with the work done in New Zealand by Atkinson, Askew and Chittenden on the use of boron to control internal cork, and in 1936 he employed Atkinson's injection method as well as soil applications in a more extensive series of experiments. Three trees, on which almost every apple had been affected by cork in the preceding year, were selected for the injection tests. In two of them solutions containing respectively 3 and 5 g. boric acid dissolved in 1,500 c.c. water were injected into the trunks on 13 June, whereas in the third tree a solution containing 10 g. was injected into the largest branch. Following the injections the tree that received 3 g. boric acid produced only 9·9% of apples affected by the disorder, while the tree that had received 5 g. produced a crop entirely free from cork disease. Neither tree showed any injury. In the tree which had received 10 g. 18·6% of the fruits showed the disorder, but none of these was on the branch into which the solution had been injected. This was, however, clearly an excessive amount, since all the leaves on the branch turned brown. Soil applications of 200 and 500 g. boric acid were also made to other trees on the same date, and both these quantities resulted in complete freedom from cork disease without any trace of injury. Similar trials with 100 and 200 g. applied immediately after blossoming were carried out in affected orchards in various parts of Finland. With the exception of two trees in one orchard which had received 100 g. and which produced a few diseased fruits, all the treated trees produced healthy crops and suffered no injurious effects. In summarizing the conclusions the author also discusses previous investigations on the physiology of boron deficiency disorders in apples and other crops.

619. OVERHOLSER, E. L. AND CLORE, W. J. 634.13-2.19  
 Six years' records of amount of cork spot fruit on individual d'Anjou pear trees.  
*Proc. Amer. Soc. hort. Sci. for 1936*, 1937, 34 : 192-8, bibl. 8.

Serious losses from cork spot have occurred in d'Anjou pear orchards in Washington State, more particularly in trees grown on *Pyrus serotina* rootstock, but to a slight extent also in trees on *P. communis* rootstock. Records kept in an orchard from 1931 to 1936 inclusive have shown that:—(1) The average percentage of fruits showing cork spot tends to be relatively high in years of low yield and low in years of high yields. (2) Despite seasonal variations certain trees tend to produce a rather uniformly higher percentage of affected fruits than do others on the same rootstock species. (3) Trees making a large annual increase in trunk circumference and possessing a large average leaf area produce a relatively high proportion of affected fruits, while trees growing less vigorously and having smaller leaves produce a relatively low proportion. This was, however, to be expected, since in years of low cropping the trees made the greatest vegetative growth and *vice versa*. In their discussion the authors note that boron has been found to cure "internal cork" of apples, and add that, although as yet there is no experimental evidence to show that this element will correct cork spot of d'Anjou pears, the results they have obtained could be explained on the grounds of some such deficiency.

620. BAILEY, J. S. AND THIES, W. H. 634.11-2.1  
 Some observations on internal cork disease of apples in Massachusetts.  
*Proc. Amer. Soc. hort. Sci. for 1936*, 1937, 34 : 187-91, bibl. 12.

Considerable attention was attracted in Massachusetts during 1936 by the presence of corky spots in the flesh, and particularly near the core, of the fruit of certain McIntosh and Cortland trees. With the latter this was accompanied by a roughness of the surface of the apple, but

no roughness was noticed in McIntosh. The disorder appears to be similar to that described elsewhere as cork, corky-core and corky-pit, but the name "internal cork" used recently by Askew and Chittenden is preferred. In the present paper descriptions are given of soil profiles and root distributions observed in trenches dug around an affected and a normal tree in each of 7 orchards. The observations indicate that the disorder is not limited to any one soil type, but that it occurs where the subsoil is unfavourable to root penetration. This discovery, taken in conjunction with the fact that the disorder was found to be partially prevented by heavy mulching and that the rainfall in the area was deficient in 1935 and during May, June and July of 1936, suggests that an association exists between the occurrence of the disease and an inadequate supply of moisture during part of the growing season.

621. HALLER, M. H. AND LUTZ, J. M. 664.85.11 : 632.19  
**Soft scald of Jonathan apples in relation to respiration.**  
*Proc. Amer. Soc. hort. Sci. for 1936*, 1937, **34** : 173-6, bibl. 11.  
 In 1935 Jonathan apples (grown in Maryland) picked at 5 different stages of maturity were held for various lengths of time at 70° F. prior to storage at 32° F. The daily rate of respiration was determined during the period of storage at 70° F. and the amount of soft scald that developed when the fruit was transferred from 70° F. to 32° F. was also recorded. The results indicate that the amount of soft scald generally increased to a maximum in fruits held for 6 to 9 days at 70° F. before transference to cold storage, and thereafter decreased in fruits held for longer periods at 70° F. Likewise the respiratory rate of the apples at 70° F. increased for a period and subsequently decreased, but the maximum in this case was usually reached in 3 to 5 days. There was thus no apparent relation between the respiratory rate at 70° F. at the time of transferring the fruit to cold storage and the amount of soft scald that developed at 32° F. There was also no apparent relation between the respiratory rate and the maturity of the fruit.
622. CORNFORD, C. E. 632.111  
**A note on frost damage investigations.**  
*Annu. Rep. East Malling Res. Sta. for 1936*, **A20**, 1937, pp. 126-30, bibl. 4.  
 Katabatic (or downhill) winds are formed on clear calm nights as the result of the cooling of trees, soils, etc., by radiation. The air in contact with such objects also cools and becomes denser than the air a few feet or yards above it. The resulting heavy air then moves into the lowest position available and this movement produces the "Katabatic" wind. At the same time on such calm evenings a light and relatively warm wind will be found to be blowing on the hill tops. The author notes the necessity for further research on the action and interaction of these two types of wind. Methods of taking air temperatures in the field on frosty nights are discussed. There was not sufficient frost in the late spring of 1937 to test the efficacy of orchard heaters, but even so the difficulty of preventing the waste of the heated orchard air by wind diffusion was encountered.
623. McWHORTER, O. T. 634.51-2.111  
**Salvaging freeze-injured walnut trees.**  
*Bett. Fruit*, 1937, **31** : 6 : 2, 17.  
 In the repair of frost injured walnut trees the following types of injury will have to be considered:—  
 (1) Top injury causing death or partial die-back of outer twigs, resulting in the growth of numerous new shoots at the tops. (2) All the outer portion killed but live wood left in the centre of the top, resulting in concentrated new growth in the lower part of the trees and along the trunk down to the black walnut stock. (3) The entire top killed resulting in new shoot formation on trunk and at base of trunk. (4) The entire tree killed to the stock, occasionally resulting in new growth below the graft. (5) Varying degrees of crotch injury often resulting in the death of the limb, possibly after first leafing and fruiting. In treating these injuries delay in cutting out is

advised until it is certain what proportion of the tree is injured. Much unnecessary damage and even total loss of the trees have been caused by cutting back unnecessarily. To repair top injury the excessive growths of new shoots should be thinned. If new limbs have to be formed, 2 or 3 times the number eventually required should be left for 2 or 3 years to provide the tree with foliage for nutritional purposes. Where the trunk only is left alive the new shoots springing on it should be untouched for at least a year, as many of them may die. Only one will probably eventually be required but for a further year the remainder should be slightly cut back to check fast growth and left to supply an increased leaf area. Crotch injury should be left undisturbed for a year, at the end of which period new cambium may have grown under the injured bark, if not, then the wound may be cleaned out and painted.

## 624. ANTHONY, R. D. AND OTHERS.

632.111 : 634.1/7

**Low temperature injury to orchards in Pennsylvania and adjoining States in the fall and winter of 1935-36.**

*Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 33-43.*

The winter of 1935-36 resulted in unusually serious winter injury to fruit trees in Pennsylvania and adjacent States, and a survey was, therefore, undertaken during the summer of 1936 to determine the extent of the injury and to discover, if possible, what factors had been primarily responsible for it. The districts visited and the observations made in each are here outlined, the main conclusions drawn being as follows :—An examination of temperature records showed that cold weather could not alone have been responsible, since in both preceding winters lower temperatures occurred in some of the affected areas without causing marked injury. The one factor found to be common to all seriously affected districts was immaturity of the trees during the winter. The period 5-9 October had been unusually cold throughout the State, and had apparently checked the normal maturing processes of the tissues. These tissues remained immature throughout the winter and were readily injured when, on 22 January, the temperature suddenly dropped from above the freezing point to 10°-20° F. below zero. The tissues damaged were those normally slow to reach maturity, namely, in the case of apples, the bases of the buds, the inner portion of large crotches, the lower trunk of most varieties and the sapwood of the lower branches of some varieties. Under the conditions of the 1935-36 winter no apple variety, not even McIntosh or Wealthy, proved very resistant to cold. Almost all bearing peach trees in the Pittsburgh area were killed outright or so severely injured as to make their recovery doubtful, but young non-bearing peaches showed much less injury. Cherries, particularly sweet varieties, also suffered to a serious extent. Factors found to have predisposed trees to injury were excessive or too little vigour, excessive manuring, heavy pruning, late cultivation, thin soil, spray injury and heavy cropping. Late picking in the case of the apple, Rome, seemed to have accentuated the injury. The amount and type of fertilizer and the time of application appeared to have influenced the degree of injury only in so far as they affected the degree of maturity of the trees.

## 625. BURKHOLDER, C. L.

634.11-1.542-2.111

**December pruning in 1935 results in severe injury to Jonathan and Stayman trees at Lafayette, Indiana.**

*Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 49-51.*

A period of very cold weather from 22 January to the end of the month, followed by an unusually cold February, resulted in severe injury to Jonathan and Stayman trees which had been heavily pruned in December. The crotches in particular were badly damaged. Winesap trees were also injured, but to a lesser extent than Stayman, while from reports on commercial orchards it would appear that Baldwin, Hubbardston and York Imperial were also more subject to injury if pruned in the autumn. It is suggested, therefore, that early pruning should be confined where possible to varieties such as Rome, Delicious and Grimes which were not injured when pruned in December, and to mature trees requiring relatively light pruning.

626. TINGLEY, M. A. 634.11-2.111  
**Frost rings in hardy varieties of apple.**  
*Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 57-60.*  
 Areas of parenchyma-like cells occurring irregularly as flecks or streaks or as partial or complete rings of varying width, concentric with the growth rings, have been observed in cross sections of the trunk xylem of McIntosh, Red Astrachan, Delicious and Northern Spy apple trees in New Hampshire. The cause of these rings is believed to be low winter temperatures, since in observations in each of the 5 years, 1931 to 1935, their numbers and extent varied with the minimum temperatures of the preceding winter. The trees showing these frost rings did not, however, necessarily show external symptoms of injury. It is thought unlikely that late spring frosts are the cause, first because the frost rings have always been found to occur at the beginning of the growth rings in positions adjacent to the late-formed wood of the previous season, and secondly because they were relatively rare in 1932 which was the only year in which a late spring frost occurred in the orchard in question. The rings were most numerous in 1934 following the production of a heavy crop in 1933 and a minimum temperature of  $-31^{\circ}$  F. early in the winter. A minimum temperature of  $-35^{\circ}$  F. occurring later in the following winter did not result in the formation of so many rings.
627. WARING, J. H. AND HILBORN, M. T. 632.111 : 634.11  
**Some observations and current studies of winter injury to apple.**  
*Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 52-6, bibl. 8.*  
 A survey in 889 Maine orchards following the severe winter of 1933-4 showed that 40.3% of the bearing apple trees and 3.9% of the non-bearing trees had been injured. The variety showing the greatest number of injured trees was Baldwin and this was followed in order by Gravenstein, Ben Davis, Stark, Northern Spy, Delicious, Cortland, Wealthy and McIntosh. Anatomical studies revealed that winter injury in apple trees is characterized by the killing of parenchyma cells and the occlusion of vessels by a substance resembling wound gum. During the winter of 1934-5 and 1935-6 a method of artificial freezing [not described—Ed.] was used to determine the relative hardiness of a number of varieties. The results ran closely parallel to the field observations made in the 1934 survey and the form of injury was found to be the same as that observed in the anatomical study. Other points made in this paper are as follows:—There is some evidence to suggest that trunk injury, which was commonly apparent on McIntosh trees in 1935 had its origin in the winter of 1933-4. The serious extent of trunk injury in McIntosh and Cortland has focussed attention on top- and double-working and the use of hardy stocks as possible means of securing a hardy trunk. So far the evidence on this aspect of stock and scion effect is conflicting. Where one-half of a Baldwin orchard had been top-worked 6 years previously with McIntosh, the top-worked trees were uninjured by the 1933-4 winter, while the remaining Baldwin trees were killed. On the other hand, Ben Davis trunks top-worked with McIntosh were also killed.
628. RAWLINGS, C. O. AND POTTER, G. F. 632.111 : 634.11-1.84  
**Unusual and severe winter injury to the trunks of McIntosh trees in New Hampshire.**  
*Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 44-8, bibl. 7.*  
 The form of injury described was confined to the trunks, the spurs being undamaged and bearing an almost full crop of fruit. The injury was first apparent in June 1936 when leaves on certain trees developed chlorosis. The bark showed no discoloration nor splitting until September, but examination showed that areas of phloem and xylem, sometimes almost girdling the trunk, were dead. In addition to McIntosh, which is normally very hardy under New Hampshire conditions, Delicious and Wealthy trees top-worked to McIntosh were affected. Elberta peach trees in the neighbourhood were, however, uninjured. In the most damaged orchard where the trees were growing under sod the soil was of rather low fertility and in places poorly drained, and the use of a sulphur dusting schedule had reduced the pH to 4.65-5.00. Other affected orchards were, for the most part, in better condition. Neither the autumn nor winter of 1935-36 was

exceptionally cold and the trees apparently matured normally. November temperatures averaged 4·3° F. above the normal. On the other hand, this type of injury has, with minor exceptions, been found only in trees which had received an application of available nitrogen in October or November, and there was no evidence of any appreciable injury in some 40 orchards which had received spring applications. The authors, therefore, feel that the question of autumn applications of nitrogen in relation to winter injury merits further investigation.

629. MATHEWS, O. R. AND CLARK, V. I. 631.586 : 634.1/7-1.543.82  
**Results of field crop, shelter belt, and orchard investigations at the United States dry land field station, Ardmore, S. Dak., 1911-32.**  
*Circ. U.S. Dep. Agric. 421, 1937, pp. 47, bibl. in text.*

The greater part of this circular is devoted to the results of field crop investigations carried out over a 21-year period, but accounts are also given of shelter-belt and fruit tree experiments. During the period in question the average annual rainfall was 15·9 inches and some drought injury was a normal occurrence in each season. Temperatures ranged from a minimum of —20° F. or lower in most winters to a maximum of 100° F. in nearly every summer. *Shelter-belt investigations.* These included a study of different species, pruning and spacing experiments, and a comparison between cultivation, mulching and lack of cultivation. The results indicate that shelter-belts should consist of only a few species of hardy trees. In order to check snow drifting, low-growing, bushy species should form the border rows on the side exposed to the prevailing winds, and for this purpose the Siberian pea-tree, *Caragana arborescens* Lam. and the Russian olive, *Elaeagnus angustifolia* L., have been found suitable. Of the taller species the best have been green ash, *Fraxinus pennsylvanica lanceolata* (Borkh.) Sarg. and American elm, *Ulmus americana* L., the former being the harder but slower-growing of the two. Where a windbreak is required quickly Chinese elm and Northwest poplar, *Populus* sp., are recommended, but, as they are not entirely hardy and will eventually be eliminated, ash and American elm should be planted at the same time to take their place later. Pruning was found to have a deleterious effect, and clean cultivation produced better tree growth than did no cultivation or mulching annually with straw. *Fruit tree studies.* The region in question is, for the most part, unsuitable for commercial fruit growing and varieties have been assembled at Ardmore mainly to determine their suitability for home orchards. The following have proved sufficiently hardy :—Apples :—Anoka, Wealthy, Oldenburg (Duchess), Hibernal (but foliage too sparse for sun protection), and crab apples, Dolgo, Florence, Transcendent, Siberian, Virginia and Whitney. Plums :—Red Wing, Teton, Radisson, Mammoth, Emerald and Cree, and the plum  $\times$  sand cherry hybrids, Opata and Compass.

630. ANON. 632.111 : 634.1/8  
**A.D.F.A. frost conference.**  
*Aust. dried Fruits News, 1936, 11 : 4 : 9-11.*

At a conference held under the auspices of the Australian Dried Fruits Association at Mildura in August 1936 a sub-committee was appointed to draw up recommendations representing the consensus of opinions of the conference concerning frost prevention. These recommendations have already been published under the title of "Frost prevention" in *J. Dep. Agric. S. Aust.*, 1936, 40 : 162-5 and are summarized in *H.A.*, 1937, 7 : 316.

631. LYON, A. V. 634.8 : 632.111  
**Vineyard heating for frost protection.**  
*Aust. dried Fruits News, 1936, 11 : 4 : 6-7.*

In preliminary trials on two nights in June 1936 comparisons were made between the effectiveness of bucket heaters each holding 1 gallon of fuel oil and "Protector" briquette heaters each holding 15 lb. of briquettes. Temperatures were read on 12 thermometers attached to the vine trellis at 3 ft. from the ground. With 60 burners of each type to the acre the oil heaters produced a maximum rise in temperature by comparison with a control plot of 5·25° F. and the

briquette heaters a maximum rise of 4·25° F. With 40 oil burners per acre the maximum rise was 3·25° F. With the oil heaters the maximum rise in temperature was reached after about 1½ hours, and with the briquettes after 2½ hours. After reaching the maximum the temperature in the oil-heated plots declined gradually until after 7 hours' burning it was 1° F. above that of the control plot. The maximum temperatures in the briquette-heated plot were recorded during the third and fourth hours, after which there was a sudden fall to temperatures similar to, or below, those of the oil-heated plot. A smoke cloud was much more in evidence over the oil-heated than over the briquette-heated plots. The "Protector" briquette burners cost 5s. 6d. each or £16 10s. for 60 burners per acre. The fuel costs about 16s. per burning per acre. The oil pots cost 2s. each or £6 for 60 burners per acre, and the fuel costs 37s. 6d. per burning per acre.

632. THOMAS, J. E. 634.8-2.13  
**A note on the treatment of hail-damaged sultana vines.**  
*J. Coun. sci. industr. Res. Aust.*, 1936, 9 : 315-6.  
 Experiments following a severe hailstorm at Mildura, in which the sultana vine crops were practically destroyed with much shoot injury and defoliation, suggest that the extra labour of re-pruning is not warranted by results.
633. MINISTRY OF AGRICULTURE, LONDON. 634.723-2.8  
**"Reversion" in black currants.**  
*Adv. Leaf. Minist. Agric., Lond.* 277\*, 1936, pp. 4.  
 This leaflet contains information regarding the symptoms and detection of "reversion". It notes that the disease is thought to be due to a virus transmitted by the big bud mite, and advocates spraying with lime-sulphur shortly before the blossoms open as a means of controlling this pest. Additional control measures include systematic inspection and the destruction of infected bushes and propagation from bushes known to be healthy. Finally it may be noted that the term "nettlehead" is reserved for "false reversion", a non-infectious temporary condition that may be caused by accidental damage to the plant.

634. SWARBRICK, T. AND BERRY, W. G. 634.723-2.8-2.654.2  
**Further observations on the incidence and spread of reversion and big bud in black currants.**  
*Annu. Rep. Long Ashton Res. Sta. for 1936*, 1937, pp. 124-32, bibl. 9.  
 The material on which the present observations were made was that used in the varietal trials noted elsewhere (see abstract 590). The data recorded are presented as additional evidence for the coincidence of reversion and big bud and as throwing some light on the factors which may influence the spread of reversion in a large plantation. The authors summarize as follows:— Reverted bushes were planted at fixed positions in a large black currant plantation and the time and place of the occurrence of new cases recorded during eight successive years. New cases of reversion were more frequent in the vicinity of the originally planted revert. There is some indication that the variety Edina is more susceptible, and the variety Baldwin less susceptible to reversion than French. Big bud occurred almost exclusively on reverted bushes, but since big buds have never been observed prior to the symptoms of reversion it cannot be concluded that big bud mite is definitely responsible for the spread of the disease, unless it can be shown that mites may be present on a bush for several seasons in sufficient numbers to transmit reversion and yet be insufficient to produce big buds. [The authors note that mites can be present in considerable numbers without building up the large population necessary to produce the typical big bud phenomenon. ED.] The evidence points to the possibility that many new infections arise through the activities of the big bud mite, but other means of spreading the disease are not precluded and it is possible that some of the bushes had the disease in a mild form when planted, and developed symptoms later.

\* Formerly *Leaf.* 377.

635. HARRIS, R. V. 634.75-2.8  
**Virus diseases in relation to strawberry cultivation in Great Britain—a synopsis of recent experiments at East Malling.**

*Annu. Rep. East Malling Res. Sta. for 1936, A20, 1937, pp. 201-11, bibl. 15.*

One of the chief obstacles to the elimination of virus in strawberry plantations lies in the fact that a high capacity for symptom masking is often combined with high resistance to deterioration but not with immunity, which has as yet not been found in the *Fragaria* species or in the cultivated varieties tested. In this paper the author traces briefly the work leading up to the identification of yellow edge and crinkle in England. He describes the stolon-grafting method of determination. He details the symptoms of both types found in different species and in cultivated varieties. The differences in susceptibility within any given variety point not only to environment but also to the existence of different strains of virus being responsible for this phenomenon. He notes that *Capitophorus fragaefolii* Ckll. appears to be the most important insect vector and that infection experiments with *Tarsonomus pallidus* have given negative results. He considers that the following points may prove useful to growers who wish to eliminate the disease :—(1) choose varieties from which virus-plants can be easily detected and removed ; (2) get runners from a strain of the chosen varieties selected and propagated to maintain adequate freedom from the important virus diseases ; (3) eliminate insect vectors as far as possible and prevent the masking of symptoms on runner beds by mites ; (4) discourage symptom masking on runner beds and plant deterioration on fruiting plantations by the provision of suitable soil conditions.

636. HARRIS, R. V. 632.8 : 634.75  
**Studies in strawberry virus diseases. III. Transmission experiments with "crinkle", 1935.**

*Annu. Rep. East Malling Res. Sta. for 1936, A20, 1937, pp. 212-21, bibl. 7.*

Symptoms differing from those hitherto associated with the yellow-edge disease were transmitted, together with those of yellow-edge, by runner-grafting, from certain severely affected plants of seedling varieties (crosses between English, and English and American commercial varieties) to "normal" Royal Sovereign plants. The symptoms thus transmitted correspond closely to those previously reported by Ogilvie, Swarbrick and Thompson as occurring naturally on Royal Sovereign in South-west England, and to those of crinkle in North-west America as described by Zeller and Vaughan. Confirmatory evidence of the virus origin of the crinkle symptoms as they occur in England was thereby obtained and the available data are considered to support the assumption that this disease is causally distinct from yellow-edge. [Author's summary.] The symptoms are clearly illustrated in 3 plates containing 11 illustrations in all.

637. MASSEE, A. M. 634.75-2.8  
**Studies on the transmission of the strawberry virus "yellow-edge" disease by insects. III. Aphid transmission experiments and period of infectability.**

*Annu. Rep. East Malling Res. Sta. for 1936, A20, 1937, pp. 229-31.*

The results of the experiments carried out in 1935 and 1936 show that the strawberry aphid (*Capitophorus fragaefolii* Ckll.) is able to transmit the virus yellow-edge disease from diseased to healthy Royal Sovereign strawberry plants during the months of March, April, May, June, July and August respectively. These investigations also show that after inoculation the typical aphid leaf-curl symptoms are first noticeable ; these are followed by the "flattening" effect, and finally the characteristic "yellow-edge" symptoms appear. [Author's summary.]

638. HARRIS, R. V. AND HILDEBRAND, A. A. 632.8 : 634.75  
**An investigation of strawberry virus disease in Ontario.**

*Canad. J. Res., 1937, 15, Sec. C., pp. 252-80, bibl. 13.*

Observations in field and greenhouse in Ontario in 1933-5 on the strawberry varieties Parson's Beauty, Premier, Forward and Glen Mary showed that symptoms analogous to the yellow-edge disease of Royal Sovereign in Europe, sufficiently defined to permit of diagnosis, were apparent only on Parson's Beauty and Forward and then only for a limited period early in the growing

season. Apparently virus-free Royal Sovereign plants from a single clone brought from England were infected during transmission experiments (runner grafting) from the local varieties Glen Mary, Parson's Beauty and Premier which possess markedly the symptomless-carrier capacity. The deterioration of Premier components in certain graft series suggested reciprocal infection between test and indicator plants. Parallel experiments at East Malling in 1935-6 provided supplementary data as follows. Of the two parent *Fragaria* species common to commercial varieties in North America and England *F. chiloensis* was found to be a symptomless carrier of yellow edge with a high order of resistance, while *F. virginiana* on the contrary developed the symptoms readily and showed high susceptibility. Some explanation is thus provided of the observed wide range of varietal reaction to disease of the yellow-edge type. In these experiments the Royal Sovereign clone providing the "normal" indicators was found to be infected with a distinct virus of the crinkle type, thus providing explanation of an observed reciprocal reaction in certain series with the Premier variety.

639. COOLEY, L. M. 634.711 : 581.144.1 : 632.8  
**Retarded foliation in black raspberries and its relation to mosaic.**  
*Bull. N. Y. St. agric. Exp. Sta.* 675, 1936, pp. 20, bibl. 2 in text.  
 Following the discovery in 1932 that black raspberry plants infected with green mottle mosaic were commonly retarded considerably in their foliation by comparison with normal plants, records of cases of delayed foliation were kept during the three succeeding years to determine whether the characteristic would provide a reliable means of detecting the presence of either the green or the yellow mosaic virus prior to the appearance of leaf symptoms. From 74 to 94% of the black raspberry plants found to be infected with green mosaic in June had been recorded as showing retarded foliation in April and May. The proportion of yellow mosaic cases discovered by this means ranged, however, from 6 to 61% with an average of only 25%. In 1933 the number of virus-free plants retarded in foliation amounted to only 0.4%, but in 1934 winter injury resulted in the inclusion of 16% of virus-free plants in the retarded foliation class. The retarded foliation characteristic is, therefore, recommended as a basis for supplementary inspection and roguing of black raspberry plants, where green mosaic control is an important consideration, except in seasons where winter injury is very prevalent. Among red raspberries neither mosaic virus caused any apparent delay in foliation.

640. HUTCHINS, L. M., BODINE, E. W. AND THORNBERRY, H. H. 634.25-2.8  
**Peach mosaic, its identification and control.**  
*Circ. U.S. Dep. Agric.* 427, 1937, pp. 48, bibl. 8.

This virus disease was first reported from Texas and Colorado in 1931 and has since been found to occur in several other States. The present paper reports the combined conclusions reached as to symptoms, transmission and control by the three authors working independently in Texas, Colorado and California. Although varietal differences are common, the disease may be identified by one or more of the following symptoms:—Breaking of colour in the flowers, retarded foliation in the spring, variously mottled and deformed leaves (whipping of the leaves by wind, chafing and bruising by wind-blown sand, non-infectious chloroses and, in the early stages, peach leaf curl caused by *Taphrina deformans* produce leaf-symptoms which may be confused with mosaic), twig abnormalities and malformation of the fruits. The virus is transmitted by grafting, but not by irrigation water, pruning implements, pollination or seed, nor is it communicated through the agency of soil. The means of transmission under natural conditions is unknown, but when conditions are favourable it spreads through orchards more rapidly than any of the other peach viruses. The incubation period following grafting is variable. When grafting is done in the spring the symptoms of mosaic are likely to appear during the same growing season, but when it is performed in the summer or autumn the symptoms rarely appear until the following spring. Cultural practices, fertilizers, orchard sprays and the injection of chemicals into the trees have all so far failed to control the disease. The removal of all diseased trees in the spring and at frequent intervals throughout the summer is, however, proving effective in

eradicating the disease in Mesa County, Colorado. Since infection through the soil does not occur, replanting may be carried out with safety at any time after the removal of affected trees.

641. PLAGGE, H. H. AND MANEY, T. J. 77 : 632.1/4  
**Some suggestions on the preparation of diseased plant materials for photographing.**

*Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 177-8.*

A method is described of preparing apples with Jonathan spot for photographing based on the bleaching properties of sulphurous acid. The method, which appears to be satisfactory for fruits containing anthocyanins and especially those that are highly coloured, has proved of value for photographing the diseases sooty-blotch and fly-speck (*Leptothyrium pomi*), apple scab, apple blotch (*Phyllosticta solitaria*), bitter pit and soggy breakdown, and defects such as spray and frost injury. Juices from citrus and pineapple fruits have also been found of assistance in photographing cut fruit surfaces, since they will retard oxidation for an hour or more. Finally, with apple scald, fruits treated with oiled paper show the disease in much sharper outline than do untreated fruits, and these might with advantage be selected for photographic purposes.

642. WORMALD, H. 632.314 : 634.22/3  
**Bacterial canker in plum and cherry trees.**

*Annu. Rep. East Malling Res. Sta. for 1936, A20, 1937, pp. 297-301.*

The author describes how bacterial canker of stone fruit trees was identified and notes the steps which are being taken to find an adequate remedy and control for the disease. These include spraying the foliage in summer, since the organism passes the summer there causing leaf spots, and the stems and branches in autumn with bordeaux. The organism lives in the stems and branches during the autumn and winter. The obvious symptoms are:—(1) curled, yellowish leaves in spring, (2) cankers on affected stems or branches in summer, (3) final withering of branches on trees girdled by the cankers.

643. BRIEN, R. M. 634.11-2.4  
**The fungi associated with mouldy-core of apples.**

*N.Z. J. Agric., 1937, 54 : 283-6, bibl. 4.*

The external symptoms of mouldy-core, a condition which has been present for many years on New Zealand apples, notably Delicious and Cunningham, are often a slight yellowing of the ground colour on the base near the stem cavity in advance of the normal change, and later a slight bronzing of the skin round the points of the crown, accompanied by premature ripening and fruit fall. Internally a zone of brown decayed tissue surrounds the core. The seeds and seed chamber are covered with fungal hyphae. The discoloured area may enlarge till the entire fruit decays. Investigation showed that certain pathogenic fungi, a list of which is given, penetrate to the core through the calyx sinus. As found by other workers it is the fruits with an open sinus which are chiefly affected, hence the trouble appears to be largely varietal, though in New Zealand the defect appears to be enhanced by climatic and environmental conditions.

644. SALMON, E. S. AND WARE, W. M. 632.4 : 634.1/2  
**The honey fungus (*Armillaria mellea*) attacking fruit trees and hops ; with observations on *Pholiota squarrosa* in cherry orchards.**

*J.S.E. agric. Coll. Wye, 1937, No. 40, pp. 18-26.*

A description is given of orchards in which apple, cherry and plum trees were infested by the honey fungus (*A. mellea*). In some cases *Pholiota squarrosa* was present, under circumstances suggesting parasitism. *A. mellea* has been found attacking hop plants in a commercial garden. This is believed to be the second recorded case on this host. [Author's summary.]

645. WORMALD, H. 632.48 : 634.11 + 634.22  
**The sooty blotch disease of apples and plums.\***  
*Annu. Rep. East Malling Res. Sta. for 1936, A20, 1937, pp. 194-7, bibl. 5.*  
 Sooty blotch, *Gloeodes pomigena* (Schw.) Colby, was prevalent in England on apples and plums in the wet summer of 1936. Tests of control methods on a small scale were carried out with Colby's Javelle Water method and with Bottomley's method. Bottomley's treatment, which is extremely simple, was, like Colby's, entirely successful. It consists in adding bleaching powder (chloride of lime) to water at the rate of  $\frac{1}{2}$  lb. to the gallon (5%), stirring well and leaving to settle for a few hours. The clear liquid is then poured or siphoned off. The fruit, placed in muslin bags, is immersed in it for 1 minute, then spread on a bench to dry for 10 minutes, well washed in tap water and left in the air to dry. This treatment was found not only to remove the blotches but also to prevent its further occurrence in apples stored after treatment.
646. SHIMA, YOSHICHIKA. 632.42 : 634.11  
**Studies on the young fruit-rot of apple tree.**  
*J. Fac. Agric. Hokkaido Imp. Univ., 1936, 39 : 143-270.*  
 The author describes the mode of infection of *Sclerotinia Malii* Tak., which causes great damage to apple trees in Japan. The field observations were carried out at the Aomori Agricultural Experiment Station and the anatomical studies at the Hokkaido Imperial University. Four phases of the disease are recognized, leaf-blight, blossom-blight, young fruit-rot, and axis-blight. Leaf-blight is first seen at about the pink-bud stage of the flowers: it starts as a small brown spot near the centre of a young leaf. It extends both towards the tip and the base, and invades the petiole. When such infection occurs on a flowering spur the axis of the spur is invaded and the second phase of the disease, blossom-wilt, results. The young fruit-rot phase is first seen as a brown fleck on the young green fruit, about half way between the stalk and the calyx end, and a light brown, transparent, viscid liquid exudes from the lesion; some of the infected fruits fall to the ground but others become "mummified", and may remain on the trees until the following spring. Axis-blight arises by the fungus extending from the infected fruit down the stalk and into the axis; the other fruits of the cluster and the rosette of leaves on the axis are attacked from the base so that they too wilt and are soon completely withered. It was found that infection of the young fruit occurred through the stigma, and may be brought about by either macrospores (of the *Monilia* stage) or ascospores. Stigma-injections gave positive results on pear, quince and medlar, but negative on cherry and plum. Control measures involve the removal and burning of all diseased parts, and spraying twice before blossoming, the first application at the dormant or green bud stage using strong lime-sulphur (Beaumé 4.5°-5.0°), and the second at the delayed dormant stage using lime-sulphur (Beaumé 0.5°-0.8°) or bordeaux mixture (0.82%); later sprayings, at the pink bud and petal fall stages are considered to be less effective, especially the latter. H. W.
647. GOODWIN, W. AND OTHERS. 632.42 : 634.11  
**The control of apple scab : Allington Pippin and Newton Wonder, 1936.**  
*J. S.E. agric. Coll. Wye, 1937, No. 40, pp. 9-17.*  
 The comparative trials of bordeaux (8 lb. copper sulphate, 12 lb. hydrated lime and 100 gallons water) and of cotton seed oil-bordeaux (6 pints cotton seed oil, 4 gallons 10% copper sulphate solution added to 95 gallons of water containing 6 lb. hydrated lime), have now been carried on at Wye since 1933, and, although in 1936 control resulting from bordeaux was slightly better than that from cotton seed oil-bordeaux, the latter would on the average appear to be the equal in fungicidal power of bordeaux and to be less liable to cause russetting.

\* See also by same author "Sooty blotch of apples and plums." *Ibidem*, pp. 295-6, reprinted from *J. Minist. Agric., Lond.*, 1937, 43 : 923-5.

648. FOSTER, W. R. 632.42 : 634.23

**Cracking of cherries.**

*Sci. Agric.*, 1937, 17 : 550.

On Vancouver Island, B.C., a bordeaux spray 2 : 3 : 40 applied against brown rot 5 or 6 weeks before picking reduced the cracking of Bing cherries from 80% to 4%. Confirmatory experiments with Lambert cherries purchased in the market, sprayed and when dry placed in water for various periods of time, gave an average cracking of 40.8% for the sprayed and soaked cherries and 74.6% for the cherries which were soaked but not sprayed.

649. DOTTI, F. 632.48 : 634.25

Influenza del solfato di rame nella lotta contro il *Coryneum Beijerinckii* del pesco. (The control of *C. Beijerinckii* by sulphate of copper.)

*Pubbl. regio Ispettorato dell'Agricoltura della Provincia di Ravenna*, 1936, pp. 25.

Field experiments on Amsden, Morellone and Triumph peaches in Northern Italy show the complete efficacy of treating the trees with bordeaux mixture containing 3% copper sulphate and 3% lime and with a definitely alkaline reaction, during the dormant season. It is suggested that where orchards are fairly badly attacked three treatments should suffice. The first should be given at leaf fall, the second between the end of December and the middle of January and the third about 20 days before flowering. In very severe cases a fourth may be interposed. The use of pure hydrate of lime of the same weight as the sulphate ensures that the spray will adhere. It is essential for every single piece of the branches to be covered with the spray.

650. MOORE, M. H. 634.75-2.42

**Notes on the control of strawberry mildew (*Sphaerotheca humuli*).**

*Annu. Rep. East Malling Res. Sta. for 1936*, A20, 1937, pp. 276-9.

The results are described of two seasons' field experiments on the control of strawberry mildew by the use of lime-sulphur and of sulphur dust. Each of these controlled the disease, though dust requires more frequent application than spray. The use of either of these as protectants is urged, treatment for fruiting plants to begin during the latter half of April and, for runner beds and maiden plantations, where fruits are not a consideration, normally during the first half of July. [Author's summary.]

651. THOMAS, J. E. 634.8-1.811.7

**A note of the effect of sulphuring the sultana vine.**

*J. Counc. sci. industr. Res. Aust.*, 1936, 9 : 313-4.

Three experiments carried out to discover the effect on yield of the sulphuring of grape vines showed that no influence was produced by regular sulphuring other than the increase of yield resulting from the control of oidium.

652. RUHMANN, M. H. 632.951

**Pests of cultivated plants**

and

HOY, B.

**Sprays and spraying.**

*Hort. Circ. Dep. Agric. B.C.* 72, 1936, pp. 68.

The injury caused by, and control of, some 50 pests attacking fruit plants and market garden crops in Canada are described in the first part of this bulletin. The second section devoted to sprays and spraying (pp. 53-66) contains information on formulae for insecticides, disinfectants, the cost of spraying and the control of rodents.

653. MORRIS, H. M. 632.7

**Injurious insects of Cyprus.**

*Bull. Dep. Agric. Cyprus, Ent. Ser.*, 4, 1937, pp. 31, bibl. 10.

An extensive list of insects is given with notes on plants, including fruit trees and vegetables, which they have been found attacking.

654. MASSEE, A. M. AND OTHERS. 634.11 : 632.768 + 632.78  
*Apple blossom weevil and codlin moth experiments in 1936. A progress report.\**

*Annu. Rep. East Malling Res. Sta. for 1936, A20, 1937, pp. 232-9, bibl. 13.*

A brief note of the different materials tested at East Malling between 1920 and 1936 is followed by an account of experiments in 1936. In 1936 corrugated cardboard bands treated with 8 variations of 3 materials were used. None proved so attractive to insects (*Anthonomus pomorum* and *Cydia pomonella*) as untreated bands, a fact which was contrary to the experience of previous years. Figures of the degree of infestation of the orchard by *C. pomonella* indicate that untreated corrugated cardboard bands will trap approximately 50% of the larvae present in the orchard. Preliminary trials of new impregnation materials are noted. All were found to cause injury to the bark.

655. JARY, S. G. 632.768 : 632.951  
*Tests of insecticides against *Anthonomus rubi* (Herbst).*  
*J. S.E. agric. Coll., Wye, 1937, No. 40, pp. 134-47, bibl. 23.*

A brief account is given of the results of applying various insecticides to control the strawberry blossom weevil, *A. rubi*, under insectary conditions in 1933, 1934 and 1935. The substances included various derris dusts, pyrethrum powders and sprays, barium silicofluoride dusts and arsenicals in different forms. Derris gave little indication of producing a rapid mortality. Pyrethrum showed on the whole slightly less toxicity than derris. A pure barium silicofluoride dust showed a considerable degree of toxicity, which decreased as the proportion of silicofluoride was reduced. Arsenical dusts showed slight but probably definite toxicity.

656. WIESMANN, R. 632.654.2 : 634.75  
*Untersuchungen über die Biologie und Bekämpfung der Erdbeermilbe,  
*Tarsonemus fragariae*, H. Zimmermann. (Investigations on the biology and  
control of the strawberry mite.)*

Reprinted from *Landw. Jb. Schweiz*, 1937, pp. 335-48, bibl. 14.

Details are given of the distribution and nature of damage caused by the strawberry mite followed by details of its biology. The greater part of the paper deals with the control aspect of the problem, and the author discusses the accepted methods used in Europe and the United States, comparing them with some successful methods of recent innovation. One such recent method entails the fumigation of the plants with a proprietary fumigant known as S. gas, which contains as its active constituent methylbromide, which is a fairly strong poison gas. It is said that complete destruction of the eggs and mites is obtained with S. gas at a temperature of 18° F. and a 2% vol. concentration, the period of fumigation being from four to six hours. This it is claimed is much safer than the hot water treatment, in which the range of temperatures is very limited and the period of treatment must not extend beyond 20 minutes. Finally it is pointed out that no elaborate apparatus, such as that used for the hot water treatment is necessary. All that is required is a tight-fitting metal chest into which the plants or runners are put for treatment.

A.M.M.

657. NEL, R. I. AND STUBBINGS, W. A. K. 634.13-2.654  
*Pear-bud mite.*

*Fmg S. Afr., 1937, 12 : 233-4.*

Instructions are given for the control of the pear-bud mite (*Eriophyes pyri* Pgst.) in S. Africa.

\* Being : Studies of impregnation of tree banding materials III. For I and II see *Ibidem for 1934*, pp. 180-4, and *Ibidem for 1935*, pp. 177-83, *H.A.*, 1935, 5 : 230 and 1936, 6 : 498.

658. CROSS, P. E. 632.754 : 634.11  
**The control of the apple capsid bug. Trial of emulsion and miscible petroleum oils, undertaken at the Horticultural Station, Denham, Uxbridge, Middlesex.**  
*Pap. Middlesex C.C. Educ. Cttee, agric. Educ. Sub-Cttee, 57, 1937, pp. 12, bibl. 4.*

Five brands of petroleum oil, 3 being emulsion and 2 miscible oils, were applied to apple trees at the early "green bud" stage on the 23rd and 24th of April, 1936. The trees were divided into 12 equal blocks, each treatment being duplicated and 2 blocks left unsprayed as controls. One of the emulsion oils gave a percentage reduction in infestation by *Plesiocoris rugicollis* of 96%, being followed closely by the two miscible oils with reductions of 94% and 91% respectively. The two other emulsion oils gave reductions of 88-89%. No damage followed the application of the emulsion oils, but from the amount of injury caused by the miscible oils it would appear that these should be applied earlier than the "green bud" stage, probably in March.

659. STEER, W. 632.782 : 634.11 + 634.13  
**Observations on codling moth (*Cydia pomonella* L.) in 1936 and The control of codling moth : a suggested spray programme.**  
*Annu. Rep. East Malling Res. Sta. for 1936, A20, 1937, pp. 250-8, bibl. 1, and p. 302.*

Most of the moths emerged in June. Eggs were laid from mid-June onwards, particularly during the latter part of June and early July. Larvae attacked fruit from the end of June, entering pears almost always through the eye and apples through the side. A partial second generation occurred, moths emerging late in August and larvae attacking apples in September. As only little codling occurred spray trials were inconclusive, but they suggest that the first cover wash of lead arsenate should be applied late in June. In the case of severe attacks lead arsenate should also be applied at petal-fall and in some varieties, where it can be done with safety, in mid-July. Otherwise some other non-poisonous insecticide such as derris should be used then. Details of a suggested spray programme are given on p. 302.

660. WEBSTER, R. L. 632.782  
**A ten year study of codling moth activity.**  
*Bull. Wash. St. agric. Exp. Sta. 340, 1936, pp. 40, bibl. 14.*

During the period 1926-35 records of codling moth activity based mainly on the number of moths caught in bait traps, have proved of value in determining the best times to apply sprays and in explaining why a spraying programme may give different results in different seasons. The principal conclusions regarding the factors influencing moth activity are essentially the same as those noted previously in a report of results obtained up to the ninth year [see *H.A.*, 1935, 5 : 623. Ed.]. In addition to the points noted in that abstract, the following conclusions from the present paper may be mentioned here :—High May temperatures encourage egg-laying and the development of the first brood larvae and produce a marked increase in moth activity throughout the season. High temperatures in August and September similarly encourage activity in the second brood larvae. Warm weather in these months may counterbalance the effect of a cool May, and vice versa. Low winter temperatures with the exception of one year have had little effect on reducing moth activity. There is some correlation between the size of the crop and codling moth damage. In general, a light crop following a heavy one is subject to greater damage than a heavy crop following a light.

661. KEARNS, H. G. H. AND UMPLBY, E. 632.9 : 634.1/7  
**The control of the insect pests of nursery fruit stock.**  
*Annu. Rep. Long Ashton Res. Sta. for 1936, 1937, pp. 90-8, bibl. 5.*

Especially in the case of nursery stock it is found essential to anticipate rather than control insect attacks when actually in being, the best procedure being to carry out routine sprayings even when pests are not in evidence. The recommendations made here are based on observations in the Long Ashton nurseries and the crops dealt with include apple, pear, plum, currant (black

and red), gooseberry, raspberry, loganberry, blackberry and strawberry. The major pests of these in the nursery are listed and programmes for control are given together with information on important points relating to particular insects and insecticides.

662. DEP. HORT. AND ILLINOIS ST. NAT. HIST. SURVEY. 634.1/2 : 632.95  
**Directions for spraying fruits in Illinois.**

*Circ. Ill. agric. Exp. Sta. 447\**, 1936, pp. 25.

After some general notes on insects and diseases, spray schedules are described for apples, peaches, pears, sour cherries, plums, bramble fruits, currants, gooseberries, grapes and strawberries. A section is also devoted to the preparation and mixing of the following spray materials:—Boiled lubricating oil emulsion, cold-mixed oil emulsions, bordeaux, zinc sulphate and lime, and oil dusts. The injection method for dispersing oil into spray mixtures is described in this section with the aid of a diagram.

663. KEARNS, H. G. H. AND MARSH, R. W. 632.95 : 634.1/7  
**A summary of fruit spraying programmes. I.**

*Annu. Rep. Long Ashton Res. Sta. for 1936*, 1937, pp. 75-89, bibl. 24.

The Long Ashton Station in collaboration with the County Agricultural Departments of the Bristol Province has now arranged to distribute to growers each season leaflets containing information on the composition of washes and on the major fruit pests and diseases. As it is impossible with many of the pests exactly to predict the spray dates sufficiently in advance to allow of long notice being given by this procedure, an indication of the materials likely to be needed for various purposes is given in the present article, which provides a summary of the standard spray programmes now used in commercial orchards in the Bristol Province. This summary is intended to be used as a background to the spray programme service and to the leaflets mentioned above. The spray programmes concern the following plants:—Apple, pear, plum, cherry, black and red currant, gooseberry, raspberry, loganberry and strawberry.

664. SWARBRICK, T. 632.94 : 634.1/7  
**The effect of spraying methods upon the cost of applying fruit tree washes.**

*Annu. Rep. Long Ashton Res. Sta. for 1936*, 1937, pp. 160-90.

Practical experience at Long Ashton (1) with knapsacks spraying, (2) with a  $3\frac{1}{2}$  h.p. machine having a maximum output of 7 gallons per minute at a working pressure of 250 lb. per square inch, first used as a stationary or semi-portable unit and later as a mobile unit, and lastly (3) with an 8 h.p. 20 g.p.m. plant used as a mobile unit, is here discussed and the conclusion is reached that the mobile method based on a suitably designed machine is most suitable for Long Ashton conditions. The reasons for this are given in full and in 7 most illuminating tables full details are given of work done, labour employed, wash used and costs per acre of many adaptations of the different systems mentioned above.

665. DAVIES, C. AND SMYTH-HOMEWOOD, C. R. B. 632.94  
**Investigations on machinery used in spraying. Part IV.† Nozzles.**

*J. S.E. agric. Coll. Wye*, 1937, No. 40, pp. 50-7, bibl. 4.

Trials have been made of the effect of variations in the details of nozzle construction on spray form and general performance of sprays. 1. Dimensions and number of vortex holes. Plates with 6 holes and with 4 holes resulted in a more even spray than plates with 2 holes. Moreover, the addition of a  $\frac{1}{16}$  in. centre hole to both 4- and 6-hole vortex plates resulted in greater range and output, provided the disc orifice was of a size to handle the flow. 2. Limitations of disc orifice. At any given pressure the dimensions of the disc orifice control output. The differences in output between a 6-hole and a 6-hole + centre opening plate, when a  $\frac{1}{16}$  in. disc was used, are examined. 3. Extraordinary nozzle discs. The possibility of using nozzle discs much

\* A revision of *Circ. 429* by W. P. Flint and H. W. Anderson.

† For previous articles see *Ibidem* No. 34, p. 39, No. 36, p. 62, No. 39, p. 61, *H.A.*, 4 : 385, 5 : 606, and 7 : 95.

wider than the normal range of  $\frac{5}{8}$  in. to  $\frac{7}{8}$  in. and experiments with such discs are discussed.

4. Diameter of the eddy chamber. The performances of nozzles of different makes are so different that it was decided to investigate what effect the diameter of the eddy chamber has on variations in spray formation. So far as range and output are concerned the diameter of the eddy chamber is found to have no effect, provided the vortex holes are the same distance apart and other things equal. But it is found that the nearer the holes in the vortex plate are to the centre of the plate, the greater is the increase in output and carry. 5. Back pressure. It is found that variables such as pump pressure, dimensions of vortex openings and disc orifices, which affect output, also affect back pressure. Comparative results of tests on all the above points 1-5 are graphed.

666. BALLOU, F. H. 632.94  
**Stationary equipment for orchard spraying and the manufacture of home-made liquid lime-sulfur.**

*Bull. Ohio agric. Exp. Sta.* 572, 1936, pp. 26.

Part 1 includes a discussion on the advantages and disadvantages of stationary as opposed to portable spraying equipment and an account of a stationary spray plant installed in the orchards of an experimental farm. Information is given on the orchard pipe system, spray hoses and guns and the costs of operation. Part 2 describes the equipment and procedure for making liquid lime sulphur. It is noted, however, that for most farms it would be more economical to purchase lime sulphur than to make it on the premises. Possible exceptions include large isolated farms and communities of small farms which normally have to pay retail prices and might with advantage establish a communal lime sulphur plant.

667. MOORE, M. H. AND MONTGOMERY, H. B. S.\* 632.951/2  
**A field spraying trial of combined fungicide-insecticide sprays in 1936. A progress report.**

*Annu. Rep. East Malling Res. Sta. for 1936*, A20, 1937, pp. 267-75, bibl. 13.

Good control of apple scab was given by four applications of lime-sulphur on Cox's Orange Pippin and Worcester Pearmain. The sprays were applied at green-bud, pink-bud, petal-fall and three weeks after petal-fall. The seasonal conditions of 1936 were very favourable for scab infection, which became extremely severe on unsprayed control trees, especially, with Cox's, those on certain rootstocks. No evidence was obtained that the inclusion of a spreader with lime-sulphur affected scab control. Lime-sulphur at 1% pre- and post-blossom was as fungicidally effective (when judged by grading scab spots on the mature fruits) as at 2.5% pre-blossom followed by 1% post-blossom. From general observation on the foliage, however, the spray at 1% throughout seemed to be the less effective. At 1% post-blossom, lime-sulphur caused fruit drop, though this did not seriously affect the ultimate crop, and was, perhaps, even beneficial. Weak bordeaux mixture (2 : 10 : 100) caused severe leaf burn, defoliation, and fruit russet; it gave efficient scab control on the fruits, though probably by indirect and undesirable means. The effect of the inclusion of refined petroleum oil as an acaricide was not followed up for reasons given. The addition of nicotine to the petal-fall spray controlled sawfly satisfactorily, whether a spreader was added or not. Inconclusive results were obtained by adding lead arsenate, to control codling moth, to the second post-blossom spray. [Authors' summary.]

668. KEARNS, H. G. H. AND OTHERS. 632.951 + 632.952  
**Combined washes. Progress report. III.**

*Annu. Rep. Long Ashton Res. Sta. for 1936*, 1937, pp. 99-117, bibl. 5.

Extensive trials, carried out in various parts of the country, of a wash containing lime-sulphur and a refined (Grade G) petroleum oil emulsified with sulphite lye, have shown the combination to be, in general, safe to apple varieties tolerant of sulphur. In one trial, in which the oil was included in all scab sprays, serious defoliation was reported, but the successful experiments

\* Appendix by W. Steer.

have now been sufficient to justify a general recommendation of the wash under circumstances when the combined wash can economically replace the separate insecticide and fungicide applications. Evidence is given which shows that the addition of the petroleum oil emulsion does not improve the fungicidal efficiency of lime-sulphur. When the petroleum oil serves no useful purpose as an ovicide or acaricide, or as a supplement for insecticides, there is no reason for recommending its use as a supplement for lime sulphur. Rotenone-containing insecticides are shown to be suitable for use in field trials for the comparison of the relative efficiencies of spray supplements as penetrants. The synthetic spreaders agral 2 and sulphonated lorol used with rotenone-containing insecticides for the control of apple sawfly (*Hoplocampa testudinea*) have been proved more effective at 0·05% than sulphite lye at 0·75%, gamma-sulphonates at 0·05% being intermediate in efficiency. The most effective spray supplement examined was a refined (Grade G) petroleum oil emulsified with sulphite lye, the superior efficiency of which as a penetrant may have been associated with solubility factors. The grade G petroleum oil proved more effective than a water-soluble spreader as a supplement for rotenone-containing sprays applied for the control of plum sawfly (*Hoplocampa flava*). [Authors' summary.]

669. MOORE, M. H. AND MONTGOMERY, H. B. S. 632.952  
**Field trials in 1936 of the fungicidal and phytocidal properties of certain new chemical preparations. A progress report. I. Fungicidal properties.**  
*Annu. Rep. East Malling Res. Sta. for 1936, A20, 1937, pp. 259-64.*  
 Three new sulphur and 1 new copper preparations were tested against lime-sulphur and bordeaux in a field trial. Comparative results as regards control and spray damage are described.
670. SHAW, H. 632.954  
**Field trials in 1936 of the fungicidal and phytocidal properties of certain new chemical preparations. A progress report. II. Phytocidal tests.**  
*Annu. Rep. East Malling Res. Sta. for 1936, A20, 1937, pp. 264-6, bibl. 2.*  
 Tests of the phytocidal properties of 15 chemical preparations are described and records of their effects are tabulated.
671. SHAW, H. AND STEER, W. 632.951.4  
**Investigations on the preparation of field-made winter petroleum-oil sprays. A progress report.**  
*Annu. Rep. East Malling Res. Sta. for 1936, A20, 1937, pp. 246-9, bibl. 3.*  
 Four emulsifiers made by Imperial Chemical Industries Limited were tested in the laboratory and in the field. The authors summarize as follows: "0·5% Whitcol J was found to be a satisfactory emulsifier for field-made winter petroleum washes containing up to 3% oil or up to 6% when efficient power agitation was employed. In the oleic acid-caustic soda "two solution" method of emulsification, the oleic acid was successfully reduced to 0·15% and the caustic soda to 0·0375% (i.e. an equivalent amount making due allowance for the hardness of the water)."
672. SHAW, H. 632.951.23 + 632.952.2 : 634.1/7  
**Spray residue investigations. I. Determinations of arsenic on pears and apples and of copper on loganberries.**  
*Annu. Rep. East Malling Res. Sta. for 1936, A20, 1937, pp. 240-5.*  
 From determination of residues on pears and apples after the application of normal amounts of lead arsenate at different dates the author shows that it is unsafe to apply such a spray to these fruits within 6 weeks of picking time or to the latest varieties after mid-July. This view is broadly in agreement with that of workers in France and New Hampshire. He notes that in any case quantities of arsenical residue approaching the permissible limit are so obvious to the eye as to render the fruit normally unsaleable. Observations on the results of applying copper sprays to loganberries show that only an insignificant residue of copper is left by applications made as late as 15 days before picking.

673. REED, R. H. 632.95

**Heating systems for apple washing machines.**

*Circ. Ill. agric. Exp. Sta. 457*, 1936, pp. 37, bibl. in text.

Experiments have shown that the removal of lead and arsenical residues from apples can be accomplished much more effectively with warmed than with cold solutions. The maximum safe temperature varies with a number of factors, but until further studies have been made 90° F. should be considered the maximum for green or summer apples, and for later varieties 110° F. for acid solutions and 125° F. for sodium silicate. In this paper the following systems of heating washing solutions are described : (1) electric, (2) steam, both live-steam and steam radiator systems, (3) hot water, including direct-heating, gravity-flow and forced-circulation hot-water systems. The installation of each system is described in detail, and its desirable features and limitations are summarized. An appendix (pp. 31-7) is devoted to methods of analysing heat losses and transfers.

674. NEWCOMER, E. J. 632.951

**Phenothiazine—a promising new insecticide.**

*Bett. Fruit*, 1937, 31 : 7 : 5.

Phenothiazine is made by combining diphenylamine with sulphur, forming a neutral compound containing the elements nitrogen, hydrogen, carbon and sulphur. It is insoluble in water, but mixes readily if a wetting agent such as soap is used. After 2 seasons' use in the Pacific North West, U.S.A., it has proved more effective in codling moth control than any of the arsenates, especially in reducing punctures. Dosage is 3 lb. per 100 gall. water with a little soap, or in light infestations  $\frac{1}{2}$  lb. is equally efficient. The residue is dark green and on that account must be removed. 90% can be removed easily. Disadvantages are that even if the residue is removed the colour of red apples (based on extra fancy colour) is reduced from 4-19%. Only in orchards normally producing 20% wormed fruit would this disadvantage be offset by the control obtained. There is also evidence of skin injury to some of the men employed in spraying. The present cost of phenothiazine is higher than that of lead arsenate but would be reduced, if a demand for it arose. It cannot be recommended without further trial.

675. JARY, S. G., AND OTHERS. 589.98 : 632.951

**The artificial drying of pyrethrum flowers.**

*J. S.E. agric. Coll. Wye*, 1937, No. 40, pp. 108-14, bibl. 11.

The authors describe with a scale drawing an experimental kiln used for drying pyrethrum flowers. In this kiln a forced draught of air is used. This is produced by a large fan and is led through steam-heated radiator blocks before passing up to the drying floor. It was found possible to control temperature within 2° C. There was a loss of pyrethrins in the sample dried at 45° C. for 21 hours and in those dried at 68° C. and 75° for  $5\frac{1}{2}$  and  $3\frac{1}{2}$  hours respectively. There was little or no loss of pyrethrins in samples dried at temperatures of 52° C. and 60° C. when comparisons were made with their air dried controls.

676. KEARNS, H. G. H. AND MARTIN, H. 632.951.8

**The use of sulphite lye as an emulsifier.**

*Annu. Rep. Long Ashton Res. Sta. for 1936*, 1937, pp. 118-23, bibl. 5.

Preliminary work on the selection of emulsifiers suitable for the preparation of petroleum oil emulsions for use in combined post-dormant washes was described in the 1932 report. The most suitable of the materials then examined was sulphite lye. Since then 5 years' experience on the merits and demerits of this substance has accumulated. The information thus gained is here set out for the consideration of manufacturers in deciding on the commercial possibilities of the introduction of stock emulsions compounded with sulphite lye. The following points are discussed :—its properties, the equipment necessary for preparing the emulsion, the method of preparation, the treatment of inverted emulsions, the oil content of the emulsion, and the emulsification of oils other than petroleum oils.

677. FORSHAW, J. E. AND OTHERS. 634.11 : 582.9  
**Experiments on the control of lichen on apple trees by means of tar oil washes.**

*Annu. Rep. Long Ashton Res. Sta. for 1936*, 1937, pp. 133-8, bibl. 3.

Six washes, three being tar oils and three mixtures of tar and petroleum oils, were tested against lichens in a severely infested orchard of cider apple trees and a few Bramley's Seedlings. High boiling tar oils afforded the greatest measure of control and of freedom from winter moth. The liberal application of such a wash in at least two successive winters was found to be essential for complete lichen control.

678. CARDINELL, H. A. 632.682  
**Trials with a bird-frightening device.**  
*Bett. Fruit*, 1937, 31 : 10 : 8-9.

An automatic exploding device worked with carbide, and hung on a pole above the tree tops has proved very effective in keeping birds away from cherry orchards. The expense of a bird watcher is avoided and the birds, useful at all other times of the year, are not injured. In trials carried out in U.S.A. the number of birds of one species alone was reduced from 90 to 16 per acre during the season. The report, as loud as a shot gun, can be made to occur at any desired interval, and is accompanied by a rapid swinging motion of the appliance which also serves to frighten the birds. The mechanism of the device is not explained here, but a full description is given in *Michigan Circular Bulletin* 160, obtainable from the Agricultural Experiment Station, Michigan State College, East Lansing.

#### VEGETABLE GROWING,\* STIMULANTS.

679. WALLACE, T. 631.4 : 634.1/7 + 635.1/7  
**A survey of the soils and fruit in the Vale of Evesham, with special report on vegetable crops. Summary.**

*Annu. Rep. Long Ashton Res. Sta. for 1936*, 1937, pp. 239-55.

Investigations were carried out in the period 1926-1934 and it is expected that a full report of them will be published in bulletin form by the Ministry of Agriculture. The notes given here summarize the main features of the extent, physiography, climate, geology and soils and of fruit and vegetable culture in the Vale of Evesham, the main conclusions reached on soils and fruit and the relationship between soils and fruit and soils and vegetable growing also being listed. The different types of fruit and of soil are considered separately, and a note is given on the preferences of various vegetable crops for particular soil types. Soil texture would here appear to be the critical factor.

680. COOPER, J. R. AND WATTS, V. M. 631.8 : 633.491/2 + 635.64 + 635.61  
**Fertilizers for Irish potatoes, sweet potatoes, tomatoes, muskmelons and watermelons.**

*Bull. Ark. agric. Exp. Sta.* 338, 1936, pp. 32.

The manurial trials described here were carried out from 1926 to 1934 at the main Experiment Station and at the Fruit and Truck Branch Experiment Station. The soil at the main station was a silt loam which had previously received little manure and was low in humus. The soil at the branch station was a fine sandy loam low in both fertility and humus. The treatments, which were replicated 3 to 6 times, consisted of nitrogen, phosphates, potash and manure, alone and in various combinations and amounts, and in the case of muskmelons included lime. The results which are tabulated and discussed in detail may be summarized as follows:—*Irish potatoes*. On the silt loam a 1-3-1 ratio proved best, and it is suggested that as much as 1,000 lb. per acre may profitably be applied. For soils similar to the fine sandy loam 800 lb. of a 3-3-2 ratio applied at one time or as a 6-12-6 fertilizer plus a top dressing of N is recommended. *Sweet potatoes*. On the silt loam 400-500 lb. of a 1-4-2 and on the fine sandy loam 500 lb. of a 1-1-1 fertilizer are suggested. Farmyard manure should not be applied to sweet potatoes on these

\* See also 788, 789.

soils. *Tomatoes for canning.* These were grown only on the silt loam soil, in which a 3½-10-1 or 3½-10-0 fertilizer gave the best results. On such soils it is suggested that 250 lb. superphosphate (20% P<sub>2</sub>O<sub>5</sub>) and 117 lb. of a 15% nitrogen fertilizer be applied. Farmyard manure might also profitably be included if it is produced on the farm, but it would be uneconomical to buy it. *Tomatoes for fresh shipment.* These were grown only on the fine sandy loam where they seemed to require approximately a 2-2-1 ratio. 500-1,000 lb. of a 5-10-5 fertilizer plus a nitrogen top dressing are suggested. *Muskmelons.* On the fine sandy loam muskmelons responded favourably to a 1-2-1 ratio, and it is thought that as much as 1,000 lb. per acre should prove profitable. Manure in amounts up to 10 tons per acre was also found to be profitable. 1 ton of lime applied once in 3 to 5 years proved necessary for good yields. *Watermelons.* A 5-6-3 ratio gave the best results on the fine sandy loam soil, and 1,000 lb. of a 6-12-6 fertilizer plus nitrogen top dressings are suggested as suitable. Manure, if obtainable cheaply, might also be applied liberally. *General conclusions.* The application of the fertilizer in a broad strip under the rows and thoroughly worked in before planting was found generally to be a good practice. Phosphorus, which quickly becomes unavailable in these soils, should be placed deep enough to be in contact with the roots. With none of the crops on the soils tested did very high applications of potassium prove beneficial.

681. RIGG, T. AND OTHERS. 633.42-2.19 : 546.27  
**Brown heart of swedes and turnips in Nelson district : a boron deficiency ailment.**

*N.Z. J. Sci. Tech.*, 1937, 18 : 750-5.

On a Nelson soil associated with a serious boron-deficiency ailment of apples the use of a top dressing of 56 lb. borax per acre on young turnips gave a large percentage of control over brown heart. This disease of swedes and turnips is shown to be related to low boron content. Healthy crops contain up to 18.8 p.p.m. of boron in the dry matter compared with 4.7 p.p.m. for a very badly affected crop.

682. WALTON, C. L. 632.651.3 : 633.44  
***Anguillulina dipsaci* (Kühn) as a cause of parsnip "canker".**

*Annu. Rep. Long Ashton Res. Sta.* for 1936, 1937, pp. 156-9, bibl. 6.

A type of canker distinguished by characteristic root and leaf lesions is associated with infestations of the eelworm, *A. dipsaci*. Dressings of calcium cyanamide at the rate of 5 and 10 cwt. per acre failed to effect any reduction in infestation. [From author's summary.]

683. COCHRAN, H. L. 633.842 : 581.145.2  
**Some factors influencing growth and fruit-setting in the pepper. (*Capsicum frutescens* L.)**

*Mem. Cornell agric. Exp. Sta.* 190, 1936, pp. 39, bibl. 52.

Experiments were made at Cornell University from 1931 to 1934, to determine the effects of temperature, soil moisture, nitrogen nutrition, length of day and atmospheric humidity on the growth and fruiting of the pepper variety World Beater. Some attention was also paid to the influences of pollination and defoliation on fruit-setting, while morphological studies were made of the abscission layer, and comparative histological studies of the embryo sacs from abscised fruits and from fruits which had set. Most of the experiments were carried out under controlled glasshouse conditions, but some were supplemented by field experiments. The results obtained are tabulated and described in detail. Maximum growth of plants occurred under conditions of high soil moisture and very high soil fertility at a temperature range of 70°-80° F. At higher and lower temperatures growth was reduced. Temperature also had a greater effect on the time of bud formation, time of anthesis, and time of fruit maturity, than did any of the other factors studied. High temperatures, high soil moisture and a normal rather than a long day favoured early bud formation, early blossoming and, except in the case of the highest temperature range of 90°-100° which caused blossoms to drop, early fruit maturity. Variations in soil nitrates had little effect on earliness. Fruit-setting was also markedly influenced by temperature. The

percentage increased from nil at 90°-100° to about 44% at 70°-80° and to about 73% at 60°-70°, but became nil again when the plants were kept throughout the whole growth period at 50°-60°. When the plants were grown at 70°-80° up to the time of anthesis, however, and were then transferred to a temperature of 50°-60°, nearly all the blossoms set fruit. An inadequate water supply in the plant caused either by low humidity, excessive transpiration or low soil moisture was the second major factor causing shedding of buds, blossoms and immature fruits. In general, plants that received frequent applications of nitrate of soda also set a significantly higher percentage of blossoms than did plants receiving low-nitrogen treatment. Increasing the length of day above normal from October to March decreased the number of blossoms formed and the percentage that set fruit. Hand-pollinating the blossoms produced no significant increase in set by comparison with open pollination, and flowers which were emasculated and bagged prior to anthesis set fruit as well as did those which were pollinated. These results are taken to indicate that the so-called "stimulus" from pollination is not essential for fruit setting in the pepper. Plants which were allowed to retain only 40% of their leaves set fruit as well as did plants with all their foliage present.

684. SALAMAN, R. N. 633.491

**The potato in its early home and its introduction into Europe.**

*J. roy. hort. Soc., 1937, 62 : 61-77, 112-23, 153-65, 253-66.*

This paper represents the Masters Lecture for 1936. The documented history of the cultivated potato in the land of its origin is placed, on a basis of archaeological data, at about A.D. 200. The first European to cultivate the potato is shown to be Costellanos in the year 1537 and not Cieza. The first documented mention of the plant in Europe has been antedated by 15 years. It was certainly growing near Seville in 1572. There were two independent introductions into Europe, one via Spain, the other via England. That represents the bare bones of the summary. The paper itself is of absorbing interest, delving as it does deep into the dust of lost civilizations. The influence of the potato on the social and political life and development of the South American continent from pre-Inca times through the Spanish conquest to the present day is carefully traced. It was probably only the discovery of the potato that enabled the earliest Indian arrivals to maintain themselves on the inhospitable altiplano of Peru and Bolivia. The potato motive which is frequent in the pottery designs of these early civilizations and its implications are discussed with the aid of a remarkable series of photographs. The paper grips the attention to the end not only from its human interest and literary merit, which last is considerable, but because one does not seem to have heard any of it before ; and that, to an abstractor, is indeed as water in the wilderness.

685. WALTON, C. L. AND OTHERS. 633.491-1.84-2.651.3

**The effect of nitrogenous fertilizers on potatoes affected with potato "sickness".**

*Annu. Rep. Long Ashton Res. Sta. for 1936, 1937, pp. 149-55, bibl. 2.*

The effect of dressings of 3 and 10 cwt. of calcium cyanamide per acre and of the same amounts of sulphate of ammonia on potatoes suffering from the attacks of eelworm, *Heterodera schachtii*, was appreciably to increase yields. These were as a whole inversely proportional to the percentages of apparently diseased plants, but were not correlated with the numbers of cysts on the roots. The apparently healthy plants contained more nitrogen in the young leaves than the apparently diseased plants, indicating that the eelworm attack had interfered with the nitrogen metabolism of the plants.

686. [ESBJERG, N.] 635.1/7 : 631.8

**Forsøg med forskellig Gødskning af Køkkenurter 1922-33. (Fertilizers for market garden crops.)**

*Tidsskr. Planteavl, 1936, 41 : 671-4, being Meddelelse 247.*

Comprehensive testings of the effect of stableyard manure and artificial fertilizers on the yield of different market garden crops have been carried out since 1922 at Blangsted (heavy soil) and Hornum (sandy soil). Twelve different treatments were tested. The results for the first 6 years

were given in report 226 and this communication gives the main results for 1928-1933. A detailed report will be published later. The fertilizers were given each year, and the vegetables were cultivated in a 6-year rotation, there being 6 duplicate plots in each field of rotation. In the years 1922-1933 the following crops were tested:—Red beet, parsley, carrots, onions, shallots, leeks, early cabbages, brussels sprouts, red cabbage, potatoes, celery, tomatoes, cucumbers. *A.* Manure versus artificial fertilizers. Cucumbers, tomatoes, carrots, onions, and shallots yielded the biggest crop when manure was given. On parsley and brussels sprouts manure and artificial fertilizers had very nearly the same effect. All other crops experimented with yielded best when supplied with artificial fertilizers. *B.* Varying the amount of fertilizers given resulted in variations in yields, but in decreasing degree as the amounts increased. *C.* The effect of nitrogen supplied as nitrate of soda or sulphate of ammonia has of course differed with different kinds of plants. Nitrate of soda had the best effect on red beets, parsley, carrots, onions, shallots, leeks, early cabbages and celery. On red cabbage and brussels sprouts the effects of the two kinds of nitrogen were about equal, while sulphate of ammonia had the best effect on potatoes, tomatoes and cucumbers. *D.* The omission of any one kind of fertilizing element had the greatest effect when nitrogen or potash were omitted. Soil reaction was about pH 7.0, but the pH decreased during the period of 12 years where sulphate of ammonia was given.

N.E.

687. OGILVIE, L. AND HICKMAN, C. J. 635.1/7-2.3/4

**Progress report on vegetable diseases. VIII.**

*Annu. Rep. Long Ashton Res. Sta. for 1936, 1937, pp. 139-48.*

This summary of work on vegetable diseases in the Bristol Province for 1935-6 includes notes on the following:—*Asparagus*:—rust, violet root rot and spotting of the stems and bower; *dwarf beans*:—anthracnose—a table is given of infection noted in a variety plot at Long Ashton—, halo blight, mosaic, foot rot; *runner beans*:—*Sclerotinia* disease; *Brassicace*:—dry rot of swedes, whiptail possibly due to lime deficiency, mosaic; *carrots*:—soft rot due to *Bacillus carotovorus*; *lettuces*:—varietal characters as affecting market value, winter hardiness, value as summer lettuces and response to various diseases, mosaic diseases, *Botrytis* disease, ring spot and deficiency diseases; *leeks*:—selection of varieties resistant to white tip caused by *Phytophthora Porri*; *mint*:—rust—complete control was obtained by dipping the runners in hot water at 105° to 115° F. for 10 minutes even as late as mid-February; *onions*:—trials laid down for testing effect of organic mercury dusts as control for white rot caused by *Sclerotium cepivorum*; *parsnips*:—a canker due to eelworm infestation; *peas*:—*Pythium* foot rot, *Fusarium* foot rots, and pea sickness due to *Heterodera schachtii*.

688. BA MAUNG, U. 635.25

**Onion cultivation in the Northern Circle.**

*Bull. Dep. Agric. Burma* 31, 1936, pp. 13.

Both onions, *Allium Cepa*, and shallots, *A. ascalonicum*, are cultivated commercially in the Northern Agricultural Circle, Burma. Garlic, *A. sativum*, is also grown to a small extent. In this paper methods of cultivation, cost of production and returns are outlined for the 3 districts Kyauksè (onions only), Shwebo (onions and shallots), and Mandalay (shallots only). In addition to English names, the Burmese names for varieties, soils and cultural operations are noted in the text.

689. SHROPSHIRE, L. H. AND KADOW, K. J. 635.34 : 632.3/7

**Diseases and insect pests of cabbage and related plants: identification and control.**

*Circ. Ill. agric. Exp. Sta.* 454, 1936, pp. 47.

Twelve diseases and 9 insect pests attacking cabbage and other cruciferous crops in Illinois are described, and control measures recommended in each case. Separate sections are also devoted

to soil sterilization by means of steam, boiling water and formaldehyde, and to the preparation of insecticides and fungicides.

690. BROWN, W. 635.346 : 632.2/4  
**A study of the deterioration of seakale stocks, with notes on some diseases of that crop.**  
*J. Pomol.*, 1937, 15 : 69-85.  
 The paper is a result of several years' investigation carried out mainly at the Slough Biological Field Station of the Imperial College of Science and Technology. It was noticed that although each seakale grower's stock is more or less peculiar to himself, unless he continues to select for propagation purposes, a rapid deterioration in forcing quality sets in while the stock may still remain perfectly satisfactory in the field. A note is given of the differences between good and bad forcing seakale. They concern growth vigour in the field, leaf shape, date of maturity, development of root system and forcing behaviour at different periods of the season. Plants of good type show both in field and forcing pit a tendency for one bud to become dominant over all others. To test the theory that deterioration is brought about by faulty manuring a trial was laid down and continued for four years. The chief result of this trial was to show that no treatment made the bad stock good and that good stock remained the same under all treatments. A description of the method of propagation by root cuttings is given. It is pointed out that since the bad stock is the more vigorous in growth in the field and possesses better roots, in a mixture of good and bad types a higher percentage of root cuttings will tend to be made from the bad type which will in the end predominate. The author considers this to be the chief, if not the only, reason for deterioration. Regarding the origin in the first place of the bad plants the theory of reversion, while admissible, seems to be unlikely. Single clone experiments over five years have failed to produce signs of reversion except in one doubtful instance. The necessity for the grower rigorously to discard all bad stocks is emphasized. New good stock brought in should be segregated until such time as it can be sufficiently propagated entirely to replace the old. Such diseases of seakale as have been encountered in the experiments are recorded and briefly described.

691. SØRENSEN, H. 635.36  
*Forsøg med Sorter og Stammer af Rosenkaal 1933-35. (Variety tests of brussels sprouts.)*  
*Tidsskr. Planteavl*, 1937, 42 : 29-44, being *Meddelelse 301*.

Different types of brussels sprouts were compared in a variety test carried out over 3 years at 4 stations. The size of the crops was determined in 4 periods of 2 months. For the 8 months total harvest period (September-April) the earliest variety yielded only 51% of the crop given by the best cropper, a late but not the most hardy variety.

N.E.

692. SEATON, H. L. AND OTHERS. 635.63 : 664.583  
**The production of cucumbers for pickling purposes.**  
*Spec. Bull. Mich. agric. Exp. Sta.* 273, 1936, pp. 40, bibl. 13.

The State of Michigan ranks first in acreage and total production of cucumbers for pickling in the U.S.A. The object of this paper is to give the grower and packer information on problems associated with yields, grades and returns per acre and with the control of diseases and pests. Much of the material presented is based on the results of experiments carried out in Michigan and elsewhere in the U.S.A. The principal sections on the production of cucumbers deal with statistics of production, climate, soil, plant characteristics, manuring, soil preparation, date of planting, sowing, interplanting, cultivation, pollination, harvesting, grading, varieties and seed production. Those on insect pests deal with cucumber beetles and aphids, while those on diseases give control measures for bacterial wilt, angular leaf spot, mosaic, downy mildew, scab, anthracnose and leaf spot. A useful summary of cultural recommendations is to be found at the end of the bulletin.

693. NICOLAISEN, N. 635.64 : 631.52  
 Studien am deutschen Tomatensortiment als Grundlage für eine Sortenbereinigung. (A study of German tomato varieties as a basis for selection.)  
*Kühn-Arch.*, 1936, 42 : 113-83, bibl. 49.

In this monumental work on tomatoes in Germany the author clears the way for the breeders to produce the ideal tomato for the fresh fruit market, for canning and for storage. Well over 100 varieties have been submitted to the closest scrutiny and the following characteristics are tabulated:—Morphological characters of leaf, flower and fruit, cropping capacity, market suitability, liability to leaf roll and to fruit cracking, firmness of fruit, acidity, preservation of colour when canned, suitability for cold storage. The soil and climatic conditions at Calbe, under which the tested plants were grown, are specified and the details given should be of great comparative value to those interested in tomato breeding.

694. JARY, S. G. AND STAPLEY, J. H. 635.8 : 632.6/7  
*Tyroglyphus dimidiatus* Herm. (*longior*) Gerv.\*  
 AUSTIN, M. D. AND PITCHER, R. S.  
*Sciara varians* Johns, its occurrence within a mushroom house, with a description of the male genitalia.†  
 and  
 AUSTIN, M. D.  
**The long-legged mushroom mite.‡**  
*J. S.E. agric. Coll. Wye*, 1937, No. 40, pp. 119-24, bibl. 16, p. 98, bibl. 1, and pp. 115-8, bibl. 2.

Three more mushroom pests are dealt with in these articles.

695. SALMON, E. S. 633.79  
**"Early Promise", a new variety of hop.**  
*J. S.E. agric. Coll. Wye*, 1937, No. 40, pp. 37-43, bibl. 12.  
 A full description is given of a new variety previously known as X35. It shows immunity or a useful degree of resistance to the common hop diseases and has a good cropping capacity. In one earlier report on it, the truth of which would appear to have been confirmed by later experience, we find, "on the whole it would seem to be a promising copper hop, valuable on account of its preservative power, but demanding judgment in use on account of its strong flavour". Sets are obtainable from Wye or East Malling.

696. SALMON, E. S. 633.79  
**Observations on the preservative value of varieties of hops of the American type.**  
*J. S.E. agric. Coll. Wye*, 1937, No. 40, pp. 44-9, bibl. 4.  
 The new hop "Brewer's Gold" raised at Wye has proved, when grown in Kent, to be higher in preservative value than the richest imported American hops in seven out of nine years. Its value is recognized in the United States and in British Columbia and sets are being sold there each year. A plea is uttered for its use in England.

697. BEARD, F. H. 633.791  
**Cultural trials with hops. II. The effect of distance of planting and number of bines: a final report on the trial with the seedling L 21.**  
*Annu. Rep. East Malling Res. Sta. for 1936*, A20, 1937, pp. 117-25, bibl. 3.

The nine treatments differed in distance of hills apart, i.e. 9 ft., 6 ft. or 3 ft. and in bines per string 1, 2 or 3. Cropping was recorded from 1931 to 1936, years which show a good range of

\*Being Investigations on the insect and allied pests of cultivated mushrooms IX.

†Ditto, X.

‡Ditto, XI.

climatic conditions. In every season the hills at 3 ft. gave the highest yield, and the plots having the hills 3 ft. apart and 1 bine per string gave high yields combined with well developed cones even in an unfavourable season. In comparing this treatment with the wider spaced plots the disadvantage of the extra cost of several cultural operations must, however, be borne in mind. The number of bines per string was found to be of much less importance than the distance between the hills. Thus the average crop from the 6 ft. 1 bine plots was only 3.71 cwt. per acre less than that of the 6 ft. 3 bine plots. Where the hills were 3 ft. apart in the rows the differences to the number of bines per string were too small to be significant. Yields and costs of the different treatments are discussed.

698. BURGESS, A. H.

633.79-1.563.2

**Hop drying.**

*J. S.E. agric. Coll. Wye, 1937, No. 40, pp. 178-82.*

The author discusses important points in the process of hop drying under the following headings:—  
*Sulphur.* The quantity of sulphur used should be adjusted according to the amount of air passing through the kiln. The amount required is about  $\frac{1}{2}$  oz. for every 1,000 cubic feet of air which pass through the kiln during the first hour of drying. When a fan is used more sulphur will be needed than in a natural draught kiln of the same size.  
*Draught.* The strength should be about 25 linear feet per minute within the body of the kiln, i.e. about 10,000 cubic feet per minute for a 20 feet square kiln.  
*Temperature of air.* The higher the temperature the quicker will be the drying, but the market value, as determined by aroma, texture and appearance must also be considered. Experiments described by Cosbie in the *Journal of the Institute of Brewing* for January 1937 lead him to the following conclusions. (1) The lower the temperature at which hops are dried the higher will be their market value as judged by appearance, rub, and aroma. (2) Hops dried at a medium temperature are preferred as producing the best flavoured beer. (3) The lower the temperature of drying the higher will be the preservative value of the hops, as measured by resin content.  
*Cooling.* The moisture in hops on the kiln at the end of drying is not evenly distributed, the central axis (or strig) of each cone being moister than the bracts (petals), and the lower layers being drier than the upper. The petals are nearly completely dry and to render them tougher cool air should pass through the kiln for a short time. After removal from the kiln the dried hops should be put in a deep heap on a sound floor and covered with cloths. Their moisture thus becomes more evenly distributed, they become tougher and can be packed in a more whole condition. The above process is known as "cooling".

699. SALMON, E. S. AND WARE, W. M.

632.411 : 633.79

**The downy mildew of the hop in 1936.**

*J. S.E. agric. Coll. Wye, 1937, No. 40, pp. 27-36.*

Experiences in this wet and downy mildew year indicate that 4 routine sprayings with bordeaux at definite stages in the growth of the bine before the cones appear are advisable to safeguard the crop in very wet seasons. A new fungicide cotton-seed oil-bordeaux is recommended. This can have nicotine incorporated in it to deal with aphid.

700. VAN DER VEEN, R.

633.71-1.8

Bemesting van Besoeki-tabak. (**Manuring of tobacco in Besuki.**) [Dutch, English summary.]

*Meded. besoek. Proefst. 56, 1937, pp. 18, bibl. 15.*

A report of manurial experiments on an estate that had previously grown tobacco for 50 years on the same soil without manures, organic or inorganic. The application of nitrate of potash at the rate of 10 grams per plant produced a more drought resistant plant, an increased yield at the rate of 2½% per gram, increased leaf length and improved quality, but the leaves of plants so manured must be fully ripe to ensure this last effect. Nitrate of potash gives improved combustion (i.e. slow but sure) of the cured leaf whereas sulphates of ammonia and potash produce deterioration in this respect, the former being the most injurious.

701. BEST, R. J. 635.64 : 632.6

The relationship between the activity of tobacco mosaic virus suspensions and hydron concentration over the pH range 5-10.

Reprinted *Aust. J. exp. Biol. med. Sci.*, 1936, 14 : 323-8, bibl. 9.

The percentage inactivation of the virus of tobacco mosaic has been determined for various pH values over the pH range 5-10. Inactivation of the virus set in at a pH value of about 7.8 and the fraction inactivated was progressively larger with increasing pH value until at a pH value of 10.2 only about one half of a per cent. of the virus added remained active. Between the pH values of 8.0 and 8.9 corresponding with 21 % and 90% inactivation respectively, the ratio  $\frac{[H^+]}{[\text{active virus}]}$  was found to be a constant but the relationship did not hold at pH values below 8. It is concluded that inactivation of the virus is associated with the neutralization of the acidic groups. The bearing of these results on the nature of the virus is discussed and it is suggested that the groups thus neutralized are an integral part of the chemically reactive prosthetic groups of the virus. [Author's summary.]

FLOWER GROWING.\*

702. LUYTEN, I. 635.935.722 : 631.532

Vegetative propagation of Hippeastrums. I.

*Yearb. Amer. Amaryllis Soc.*, 2, 1935, pp. 115-22, bibl. 5 and II. *Meded. Lab.*

*PlPhysiol., Wageningen*, 48, 1936, pp. 252-60, bibl. 7.

The author has found that it is now possible to get large quantities of pure stock from any Hippeastrum bulb by the scooping method, a full account of which process, with illustrations, occurs in English in the first of the two papers cited. Briefly the process is as follows:—Any foliage on the bulb is removed. The basal plate is removed with a scooping knife (obtainable from Heenk, Groote Houtstraat 99, Haarlem), care being taken to keep the cutting surface of the knife parallel and as close as possible to the spherical surface of the bulb-base (or basal plate). Next the bulb is cut lengthwise in half, parallel to the surface of the foliage leaves, the necessity for a clean cut indicating the use of a fairly large knife for the purpose. The scales are then removed starting from the centre. The separate scales are put in a slightly slanting position with their hollow side down in an earthenware seed pan, three-quarters filled with moist fine sand, and the pan is then filled to the brim with similar sand so that only the ends of the exceptionally long scales protrude. They are then kept at a constant temperature of 30° C. and the sand is kept moist by spraying every other day with a fine nozzle and covering with a pane of glass. If kept out of doors they should not be in direct sunlight. The pans should be inspected every 3 to 4 weeks. After 2 months the first tiny bulblets will have formed on the scales and after 3 months may be removed with a sharp knife and planted in fertile soil. This should be in a hot house under glass at a ground temperature of 25-28° C. and air temperature of 25-26° C. Bulbs which have had a period of active growth and so have assimilated freely are most suitable for scooping and consequent regenerations and best results were achieved where scooping was done in the months May to September.

703. JARY, S. G. AND AUSTIN, M. D. 632.64

"Meta-fuel" and slug control.

*J. S.E. agric. Coll. Wye*, 1936, No. 40, pp. 183-6, bibl. 1.

Experiments show that solid fuel known as "meta"† and metaldehyde are both attractive and toxic to slugs and snails but show no appreciable toxicity to woodlice or leather jackets. The direct contact action is appreciable and may cause death, while meta bran bait is probably toxic when ingested. Under favourable weather conditions broadcasting will probably have the greatest success. Otherwise, heaped and suitably protected from the weather, the bait will

\* See also 791-793, 795.

† Used for years in this country as a substitute for methylated spirits for boiling kettles, etc.

remain attractive and toxic for some weeks. A useful concentration is 1 tablet of meta (=about 4 g.) to 8 oz. bran or 1 : 56 by weight. Its action is not immediate, but the pests are prevented from regaining natural shelter by its effects; are partially desiccated by vigorous slime exudation, and die shortly.

### CITRUS AND SUB-TROPICALS.

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| 704. | MARLOTH, R. H.<br><i>The citrus industry in South Africa.</i><br><i>Emp. J. exp. Agric., 1937, 5 : 154-61.</i> | 634.3 |
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- In the course of a general article on the citrus industry in South Africa it is mentioned that research on the following problems is being undertaken by the Subtropical Horticultural Research Station at Nelspruit and by other interested bodies:—The validity of the supposed superiority of the rough lemon over the sweet orange as a rootstock on normal citrus soils; the selection of superior stocks from among the chosen group; the reason for the inadequacy of the sour orange stock in S. Africa in view of its success in nearly every other country; the finding of a suitable stock for the tangerine, which shows incompatibility with rough lemon; the comparison of rootstocks from various parts of the world with different commercial scion varieties on different soil types and with different climatic conditions. Investigations on manurial problems are carried out locally in conjunction with a general investigation on the fundamentals of citrus manuring at Nelspruit. The inherent variability of the trees has been minimized as far as possible by the use of seedling stocks raised from one rough lemon parent tree giving 95% apogamic seedlings which are submitted to rigorous roguing during growth. Scion buds were all from one parent tree of known record. A thorough investigation of irrigation problems both practical and physiological is also one of the major projects at Nelspruit. Minor problems receiving attention are top-working, tree injection, girdling, mottle-leaf control, artificial coloration, chemical identification of citrus species by colorimetric tests, selection of possible future commercial varieties, frost protection, root-growth studies and the effect of spray materials on fruit quality.
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| 705. | HODGSON, R. W.<br><i>The citrus industry in Egypt. Prospects, problems and possibilities.</i><br><i>Publ. Minist. Agric. Egypt, 1937, pp. 15.</i> | 634.3 |
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- The author outlines the conclusions he has drawn from a study of the citrus industry in Egypt. Some of the points he makes are as follows:—*Economic prospects.* Low costs of land, labour, water supply, etc. and satisfactory yields should make it possible for Egypt to compete with other Mediterranean countries in the production of oranges and mandarins for export, although it may take several years before the consumption of citrus fruits in Europe increases sufficiently to encourage a return to reasonably high price levels. *Varieties.* The best orange varieties for an export trade would appear to be Balady (the native type), Valencia and Jaffa, and the best mandarin the Mediterranean or Balady. Selection work is, however, required to reduce the number of seeds in the two Balady varieties. *Rootstocks.* The sour orange gives satisfactory results on heavy soils and the Balady lime is well adapted to light soils. On medium soils there seems little to choose between them. The sweet lime (lemon) gives the best results for the Jaffa orange during the first few years but the trees are short-lived. The rough lemon, which fortunately is little used, induces very poor quality in mandarins when grown on light soils but fairly good fruit on heavy soils. *Spacing.* It is suggested that the trees, half of which are to be permanent, should be planted  $3\frac{1}{2}$ -4 metres apart, one-quarter being removed when crowding first becomes evident and the remaining quarter 2-3 years later. *Other points.* Measures which would appear desirable in Egypt include the planting of more windbreaks, the lighter and more careful application of irrigation water, and the more careful training of young trees. Finally the author discusses some of the problems relating to the development of an export trade.

706. EL SAWY, A. 634.3

**Description, yield and commercial value of the main citrus varieties.**

*Leaf. hort. Sect. Egypt* 49, 1936, pp. 8.

Brief descriptions are given of the Common Egypt orange, Sugar orange (Sukkary, Tounsi and Soliman Pasha are 3 strains), Blood orange, Khalily Red orange, Valencia Late, Jaffa or Shamouty, Navel, Mandarin (Yousif Eff. Balady) Clementine Mandarin, Egyptian lime, Persian lime, Common acid lemon (Adalia), Sweet lemon, grapefruit (Marsh Seedless, Duncan, Triumph), and Nareng or sour orange. Average yields at different ages are tabulated for a number of these types, and average monthly prices ruling on the Cairo market from October 1933 to June 1934 are quoted.

707. CAMP, A. F. AND JEFFERIES, J. H. 634.323

**A study of citrus varieties.**

*Citrus Ind.*, 1937, 18 : 1 : 5-7, 20.

A comparison is made between 128 trees each of 4 varieties of grapefruit comprising Marsh Seedless and 3 seedy strains, selected as Duncan (A), Excelsior (B) and Walters (C). The last named does not correspond to type. The trees since planting in 1925 were grown under identical conditions, were interspersed on the same plot so as practically to eliminate soil differences, and were on rough lemon stocks raised from the seed of one tree. Marsh Seedless has produced the greatest growth as measured by height, spread, and area of trunk cross-section, and has produced the largest amount of fruit. The Marsh shows no bronzing or frencing (mottle leaf) while all the seedy varieties are bronzed, some are frenched and all are in poor condition.

708. BAHGAT, M. 634.337:663.815

**The lime and its products.**

*Leaf. hort. Sect. Egypt* 47, 1936, pp. 4.

The product with which this leaflet is particularly concerned is lime juice. Among the points made it is noted that from August to November the local markets are flooded with Egyptian limes. In order to avoid this glut it is suggested that some of the crop should be stored in mid-December at 5°-7° C. when it will keep for about 3 months, or be placed in alternate layers with dry, white sand, as is practised in country districts. As an alternative the juice can be preserved, and some of the difficulties involved in this process are briefly noted.

709. BRICHET, J. 634.31

**Création d'une jeune orangerie. (The formation of a new orange grove.)**

*Bull. Syndicat algérien Agrumes* 4, 1936, pp. 34.

The following are some of the more interesting points made in this paper:—*Choice of rootstocks.* The sour orange is the stock most commonly used in Algeria. At its best it shows adaptability to various soils and is vigorous, easily worked and perfectly compatible with all cultivated varieties of citrus, but unfortunately lack of selection has resulted in marked variability and in the production of inferior types. *C. maxima* and *C. paradisi* have sometimes been recommended as stocks for rich, slightly moist soils, but it is pointed out that neither has ever been fully tested. The trifoliolate orange has proved an excellent stock for alluvial soils, rich in humus and low in lime, and is compatible with the mandarin oranges, Satsuma, King-Siam and kumquat, and with the common tangerine. To these varieties it imparts great productivity and resistance to cold, but unfortunately it is difficult to work and is little used in nurseries. The rough lemon is recommended for dry, sandy soils, but its use is restricted by its susceptibility to gummosis, especially when employed as a stock for kumquat, Satsuma and lemons. *The isolation of varieties.* It has been demonstrated in Morocco that the normally seedless Clementine orange produces seed when interplanted with mandarin oranges. The exact effect of different varieties in effecting seed formation in other "seedless" citrus fruits is unknown, but observations indicate that some degree of fertilization is likely to occur in many cases, and the advice is therefore given to isolate orchards as far as possible and to plant them with only one variety. *Windbreaks.* Of the four species commonly used as windbreaks eucalyptus grows the most

rapidly and will provide shelter for large groves, but it suffers from the disadvantage that its roots occupy wide areas of soil. Cypress is less voracious, grows more slowly, and ultimately becomes so dense as to prevent adequate ventilation. Casuarina and tamarix can be grown on heavy and somewhat saline soils, but the former loses its lower branches rapidly and does not live sufficiently long, while the latter only grows sufficiently high to protect very limited areas. In Algeria the general tendency is to plant windbreaks too close together and allow them to become too dense, so that they waste excessive areas of soil, provide too much shade and prevent proper ventilation. In addition to the points mentioned above this paper discusses choice of soil, climatic conditions, preparation of land for planting, arrangement of trees in the grove, spacing (6 m. to 7 m. 50, according to variety, for common types, and 4-5 m. for dwarf species such as Satsuma or kumquat), manuring before planting, the question of transplanting the trees with a ball of earth or bare roots (the latter method, if properly done, is to be preferred for a number of reasons. In practice one of the main disadvantages of buying trees with balled roots is that the balls are excessively reduced in size to facilitate handling and transport), methods of planting, the irrigation of new groves, and interplanting with other fruit species (not recommended despite certain examples of successful interplanting).

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| 710. MILSUM, J. N.<br>The local mandarin orange.<br><i>Malay. agric. J., 1937, 25 : 234-8, bibl. 7.</i>   | 634.322        |
| The mandarin commonly grown in Malaya has been identified by Prof. T. Tanaka as <i>Citrus suhiensis</i> Hort. The Suhuikom of Canton. A description is given. The usual method of propagation by the Chinese is by marcots. There is, however, no reason to believe that it could not be propagated by budding or even by cuttings. Pruning is directed to obtaining a widely developed fruiting frame, necessary because of the dense habit of the orange. The trees begin to bear at 4 years from planting and are profitable until from 10 to 15 years old. Though ever-bearing, there are two main cropping seasons, namely February to May and July to November. The principal disease is a root rot attacking trees in either heavy or light soils which for one reason or another do not promote vigorous growth. A number of mandarin orange varieties commonly imported from China are described.  |                |
| 711. EL SAWY, A.<br>Characteristics of the main citrus stocks.<br><i>Leafl. hort. Sect. Egypt 50, 1936, pp. 5.</i>  | 634.3-1.541.11 |
| 1. Nareng or bitter orange ( <i>C. Aurantium</i> ) is the most widely used rootstock. It is particularly suitable for heavy soils and in sandy soils it has proved inferior to lime and rough lemon. Oranges and mandarins are entirely compatible with it, but some lemons show a pronounced swelling above the union indicating a lack of congeniality. Yields of oranges and mandarins, except Jaffas, Navels and Satsumas, are good. The quality of fruits produced by trees on this stock is excellent. 2. Balady lime ( <i>C. aurantifolia</i> ) is well adapted to poor, sandy soils but not to wet heavy soils. It is rather less easy to bud than most other types and the percentage "take" is generally somewhat lower. Owing to the much branched, very fibrous root system trees on this stock should be transplanted with a large ball of earth, and at the same time about two-thirds of their leaves should be stripped off. Scions grow vigorously on it and bear large crops of excellent quality fruit. 3. Rough lemon ( <i>C. Limonia</i> ) is also suitable for light soils, but may be used on heavy soils. Its chief advantage is the rapidity with which it forms a tree, and it appears to have a particularly desirable influence on the vigour and yield of Navel orange. Fruit quality would appear to be satisfactory. 4. Sweet lemon ( <i>C. limetta</i> ) is commonly propagated from cuttings, although seedlings are to be preferred. It is suited to light soils but not heavy, and it suffers more than any other stock from high water tables. The trees formed are usually dwarfed and short-lived except in the case of Satsuma orange and seedless lime. The fruits of trees on this stock are large and relatively thick-skinned. 5. Sweet orange ( <i>C. sinensis</i> ) is rarely used in Egypt. It shows greater seedling variation than the sour orange. |                |

6. Citron (*C. medica*), though it has been used extensively in Egypt, is a very poor stock, producing dwarfed trees which are usually unhealthy and short-lived, and yield coarse fruit of poor quality.

712. BRICHET, J.

634.31 : 631.541.44 : 575.252

La sélection des greffons en vue du regreffage des orangeries et de la production des plants d'agrumes. (Selon selection in relation to the topworking of orange trees and to citrus propagation in general.)

*Bull. Syndicat algérien Agrumes* 8, 1936, pp. 32.

The various measures necessary for the elimination of citrus trees untrue to type and thus for the production of a greater degree of standardization in Algerian orchards are discussed. Rootstock variability is considered first. The sour orange, which is the principal rootstock in Algeria, varies considerably, many of the forms found being hybrids, and careful selection of parent trees is desirable. Further selection in the nursery to eliminate seedlings arising as a result of fertilization is also necessary. Another possibility is vegetative propagation. In one experiment 45% of a series of terminal shoot cuttings placed in sand in a hothouse rooted satisfactorily, and in another preliminary trial root cuttings have given promising results. Budwood selection is the second important consideration. This necessitates keeping records of the following characteristics:—(1) productivity, (2) the presence of diseases such as psorosis and gummosis, (3) the resistance of the fruit to diseases and its keeping quality, (4) the presence of mutations giving rise to inferior types, and (5) the number of seeds produced per fruit. With established orchards standardization can only be achieved by eliminating the multitude of undesirable forms. Where the trees are still healthy and vigorous, this can be achieved by reworking in one of several ways:—(1) by means of the simple crown graft or by the modified crown grafting method proposed by du Breuil. The main advantage of these methods is that almost any piece of properly ripened young wood may serve as a scion, whereas with budding methods the amount of suitable budwood from recorded branches must necessarily be limited. In fact the author suggests that even in the case of nursery propagation crown grafting might well be employed to increase the available supply of selected scion material. The main disadvantage of crown grafting is that it requires greater skill on the part of the operator and more careful choice of time than does budding, and hence in practice the latter is usually preferred. An important point to remember in crown grafting is that the trees should be deheaded at least 15 days before the grafts are made. (2) The side bark graft may be made at any season of active growth, but the method is rarely employed. It resembles du Breuil's crown graft except that the scions are inserted along the branches instead of at the end of a deheaded branch or stem. (3) Budding may be done on mature trees with breaking buds in the period April-June or with dormant buds in the autumn. In the first case an ordinary T incision is to be preferred and in the second case an inverted L incision. (4) A patch budding method used in Spain where it is referred to as budding "à la plancha". In this method more or less circular patches of bark bearing one or more buds are taken during June from wood 2 or 3 years of age and are placed in similar patches cut out of the stock branches. Each grafted branch is cut back to within 40-50 cm. of the point of insertion of the patch bud, leaving a certain number of leaves above the bud, and cutting back to the point of grafting is delayed for 1 or 2 years until the scions are growing vigorously. In this way the trunks and main branches are always protected to some extent from the sun and the trees also suffer a less marked check to growth than is incurred by the methods involving drastic deheading.

713. BIALOGLOWSKI, J.

634.334 : 581.13

Effect of extent and temperature of roots on transpiration of rooted lemon cuttings.

*Proc. Amer. Soc. hort. Sci. for 1936*, 1937, 34 : 96-102, bibl. 3.

Rooted Eureka lemon cuttings, 3 to 3½ months old, were placed in lidded jars containing nutrient solution. The jars were submerged in a bath in which the temperature was raised at intervals by 5° C. stages from 0° C. to 40° C. The aerial portions of all the plants were subjected to

approximately the same condition of temperature (25° C.), humidity (60-65%), light intensity (about 300 ft. candles) and average air velocity (130 ft. per minute) throughout the experiment. A rapid and standardized method of weighing was used to determine transpiration losses. The results show that, during a 12-hour period of illumination the plants transpired most actively at root temperatures of 25° and 30° C. The rate of water loss was retarded slightly at 35° C., and very markedly at root temperatures above 35° C. and below 25° C. During the period of darkness, on the other hand, transpiration was not affected by root temperature changes within the range of 0° to 40° C. Root dry weights and leaf areas were also determined, and it was found that, at a root temperature of 25° C., the amount of roots required for transpiration under the conditions of this experiment was at least 130 milligrams root dry weight per square decimeter of leaf area. At lower root temperatures the factor limiting water loss was gradually shifted from amount of roots to root temperature. The same limiting value of 130 milligrams was also found when roots were progressively removed at a constant root temperature of 25° C. The reduction in the amount of roots below this value resulted in decreased transpiration losses, but even when these losses were only  $\frac{1}{2}$  to  $\frac{1}{3}$  of the loss before root removal the plants showed no visible signs of distress. Finally, it is noted that a direct relationship between root dry weight and root surface has been established for this plant material.

714. HALMA, F. F. AND COMPTON, C.  
Growth of citrus trees.

634.3 : 581.14

*Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 80-3, bibl. 4.*

By taking monthly measurements of the cross-sectional area of the trunks it was shown that the Washington Navel orange tree has an active growing period of 6-7 months under the climatic conditions of the interior of southern California. This period was the same in 3 seasons whether the rootstock was sweet orange, *C. sinensis*, or sour orange, *C. Aurantium*, and whether irrigation water was applied frequently or infrequently. Similar measurements made in 1 year on the trunks of Eureka lemon trees growing in 4 plots indicated that the active growth period was 9-10 months regardless of whether the trees were own-rooted (raised from cuttings) or were budded on grapefruit stock, *C. paradisi*. Soil temperature records taken in the orange plots at a depth of 24 in. suggest that this is the most important limiting factor for the growth of citrus under field conditions. The relatively inactive period corresponds to a temperature of about 65° F. or lower. Only irregular temperature readings were taken in the lemon plots, but as these show approximately the same seasonal curve as was found in the orange plots, it would seem that Eureka lemon trees are able to grow under a wider range of soil temperatures than are Washington Navel orange trees.

715. SHAMEL, A. D. AND OTHERS.  
Bud selection in Eureka and Lisbon lemons and progeny tests of bud variations.

*Tech. Bull. U.S. Dép. Agric. 531, 1936, pp. 43, bibl. 19.*

Systematic individual tree-performance studies were started in 1911 in established orchards of full-bearing Eureka and Lisbon lemon trees, and progress reports on these studies have been published earlier [see bibl. of 19 refs.—Ed]. Bud variations were found to occur as individual fruit, limb or entire-tree variations. The second phase of the investigation has been a study of the performances of progeny trees propagated vegetatively from selected parent trees in the original performance-record plots and from bud variations found in and near those plots. This paper contains the results of some of the studies of these progeny trees made over the period 1918-34, and deals primarily with the degree of perpetuation of the characteristics of the outstanding variations. As regards cropping the progenies of limb and entire-tree variations have produced consistently large or small yields according to the relative quantities of fruits borne by the parent limb or entire-tree variations. The high-yielding progeny trees have shown moderate vegetative growth with an abundance of oval-shaped, deep-green leaves. Some of the progeny trees have tended to bear most of their fruits during the spring, others during the autumn, while in other cases there has been a distinct tendency to bear uniform quantities of lemons throughout the year. In shape and size of fruits, texture and thickness of rind, juiciness and acidity of the juice the

different progenies have been very similar to their parent variations. The principal characters of 10 of the more important variations found in Eureka lemons and 9 in Lisbon lemons are described, and illustrations and tables are provided showing the close resemblance in fruit characters between these parent variations and their progeny. The progeny trees have borne uniform crops of fruits in cases where the parent variations bore uniform lemons, while trees propagated from variations that produce variable fruits have borne crops with about the same degree of variability as the parent variations. The uniform parent variations are regarded as inherently stable strains while the variable parent variations are classed as inherently unstable strains. From the results of these progeny studies it is concluded that bud selection based on performance records makes it possible to isolate and propagate inherently stable and commercially superior strains of Eureka and Lisbon lemons, and at the same time eliminate commercially inferior and inherently unstable strains by systematically selecting only from inherently stable and superior parent trees. In established orchards trees of inferior strains can be replaced by desirable types through top-working or replanting.

716. HAAS, A. R. C. 634.3 : 581.192  
**Total pectinous material in the vegetative portions of citrus trees.**  
*Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 84-7, bibl. 1.*  
 Pectinous materials (determined as calcium pectate) were found to occur in large concentrations in the leaves and bark of orange, lemon and grapefruit trees. In trees of several varieties growing on sour orange, sweet orange and rough lemon stocks, the bark of the stock just below the bud union almost invariably contained a lower percentage of total pectinous materials than the bark of the scion just above the union. Samples of scion bark collected in December usually possessed higher percentages than samples collected in October. The content of total pectinous materials was highest in lemon and grapefruit bark samples, and it is recalled that the fruits of these species are also particularly rich in these materials. No significant differences were found between the contents of healthy and mottled leaves and no relation to fertilizer practice was apparent.
717. ROSEAU, H. 634.31-1.67  
**Les sols d'orangeries. Technique des irrigations. (Water relations of soils for oranges and the technique of irrigation.)**  
*Bull. Syndicat algérien Agrumes 6, 1936; pp. 53.*  
 A study was made of the factor of water supply as affecting the growth of orange trees and to determine to what extent it might be possible to modify this factor advantageously. The present paper is addressed primarily to growers and is divided into several main sections. In the first section the water requirements of the orange tree are discussed in general terms. In the second section the influence of soil texture and structure on water supply are discussed in a similar manner, and mechanical analyses of soils and subsoils from some 15 plots from 4 areas in Algeria are tabulated. In a discussion on the water relations of these soils particular attention is paid to the question of permeability and the factors that affect it, and the method of estimating permeability in the field evolved by Müntz, Lainé and Faure is described. Terms used in irrigation are defined and the principles governing the application of water to various soil types by the furrow method are outlined. In concluding the author makes the following general recommendations:—(1) Select for planting orange groves such soils as are moderately permeable, and possess a satisfactory water-holding capacity, and avoid soils that are very light or heavy. (2) A smooth slightly sloping area is desirable. (3) Use surface cultivations rather than ploughing in the grove. (4) Determine the following characteristics of the soil:—(i) texture, (ii) degree of permeability, (iii) water-holding capacity, (iv) hygroscopic moisture and (v) wilting coefficient. At the same time calculate the output of the irrigation supply channel, and with a knowledge of this figure and the above soil characteristics it is then an easy matter to determine (using the methods described in this paper), the number of furrows that can be supplied at one time from the main channel, the length and distance apart to make the furrows, and how long to continue irrigating.

718. COMPTON, C.

634.3 : 581.13

**Water deficit in citrus.***Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 91-5, bibl. 2.*

Diurnal changes in the "relative saturation deficit" or R.S.D.,  
i.e. (weight at saturation—weight when picked) 100

weight at saturation

were studied during 1936 in leaves of 6-year-old Washington Navel orange trees on sweet orange rootstock. The trees received two irrigation treatments; in one plot water was applied frequently, the R.S.D. was maintained at a low value and fruit growth was kept at a maximum, and in the other plot the R.S.D. was allowed to reach a definite peak beyond the point at which fruit growth ceased before water was applied. Leaf samples were collected at intervals of 2 to 6 hours during periods of a few days in July, August and November. The results indicate that high air temperatures produced no appreciable differences in the R.S.D. between plots, in which the soil moisture was above the permanent wilting percentage, but which had been irrigated at periods of 5 and 36 days before the observations were made. Marked differences in the R.S.D. occurred between a plot low in soil moisture and one containing moisture well above the permanent wilting percentage. These differences were obliterated when irrigation water was applied, but only after a period of several hours had elapsed. An increase in the circumference of the fruit, on the other hand, occurred within 1-2 hours after water had been applied. Thereafter for at least 6 days the R.S.D. and the increase in size of fruit were practically the same in both irrigation treatments. Under conditions of adequate soil moisture, strong wind and a low relative humidity produced a somewhat higher R.S.D. than was found on the following day without wind, but there was no difference between the treatments. From these results it is concluded that under conditions of high temperature and low humidity, such as prevail at Riverside during the summer, lack of available soil moisture appears to be the most important factor in producing a high R.S.D. in leaves of Washington Navel orange.

719. CAMERON, S. H.

634.31 : 581.192

**Loss of nitrogen through abscission of immature oranges.***Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 88-90, bibl. 3.*

During 1935, a year of heavy bloom, the drop of fruit from two 7-year-old Valencia orange trees at Los Angeles, California, amounted to 20,476 and 15,888 fruits which contained totals of 54.87 and 49.71 grams of nitrogen respectively. The crops in 1936 resulting from this heavy bloom amounted to 325 and 365 lb. 1936 was a year of light bloom, and the two trees dropped 835 and 1,097 fruits containing 2.17 and 3.12 grams nitrogen respectively and will probably mature small crops in 1937. Dropping was found to occur in two periods, which were very distinct in the year of heavy bloom but were not so conspicuous in the year of light bloom. The data are insufficient to state definitely whether the drop is due to, or responsible for, a nitrogen deficiency in the tree, but the development of a shortage of nitrogen is suggested by the fact that the nitrogen content in fruits of equal dry weight decreased as the season advanced.

720. FOOTE, F. J. AND McELHINEY, J. B.

634.334-1.416.1 : 581.192

**Effect of available nitrogen in soil on sulfate and boron in lemon leaves.***Calif. Citrogr., 1937, 22 : 346, 378-9, 380.*

The rate of absorption of sulphate by lemon trees on the Limoneria Ranch, Santa Paula, California, is shown to depend on the relative concentrations of sulphate and nitrate in the soil solution. Thus the concentration of sulphate that is harmful from a production standpoint depends upon the amount of nitrate available. Conversely the concentration of available nitrogen that should be maintained in the soil is influenced by the amount of sulphate present in the soil solution. The rate of boron absorption relative to other ash constituents, except sulphate, does not appear to be greatly affected by the concentration of nitrate in the soil. However, where nitrate is not available in sufficient amount to support normal growth

boron accumulates in the leaves faster than it does if growth is not retarded. [From author's summary.]

721. MILAD, Y.

**Manuring of citrus trees.**

*Leafl. hort. Sect. Egypt* 48, 1936, pp. 4.

In a good loam or clay soil not subject to waterlogging, alkali, etc., a suggested manurial programme is:—Beledy manure [a farmyard manure containing 0·4% N—ED.] 100-150 kg. per bearing 6-8-year old tree in one or two applications plus nitrates (15-16% N) 1·1-1·5 kg. per tree in 3 equal applications in March, May and July. For similar trees in light soils the Beledy manure should be increased to 150-200 kg. and the nitrates to 1·5-2·0 kg. applied in March, May, July and September. These figures may be regarded as averages and the amounts applied may often be profitably increased by 25-50%. For bearing trees over 8 years old the quantity of fertilizer should be increased by  $\frac{1}{2}$  or  $\frac{1}{3}$  or more. For young bearing trees, 3-6 years old, the quantity may be reduced to  $\frac{2}{3}$  or  $\frac{1}{2}$ , and for non-bearing trees 1-3 years old to  $\frac{1}{2}$  or  $\frac{1}{3}$ . There is so far no evidence to show that citrus trees growing in fertile soils and manured as advised above require either phosphates or potash, but it is suggested that small dressings of both might be applied as a safeguard to old orchards which have received little organic matter.

722. ANDERSSEN, F. G.

634.31-1.8 : 664.85.31

**Citrus manuring. Its effect on cropping and on the composition and keeping quality of oranges.**

*J. Pomol.*, 1937, 15 : 117-59, bibl. 41.

The primary object of the work was to determine the interaction of the artificial fertilizers commonly used in citrus orchards and their influence on the composition and quality and on the keeping quality of oranges. Preliminary information acquired on the effect on cropping and on general growth is also included in view of its bearing on the later results. There were 20 treatments and six replications of 5 tree plots and all data were statistically analysed. The fertilizer trials were carried out on an estate of the African Realty Trust. The trees were 8-year-old Washington Navel on rough lemon. The soil was a well drained sandy clay well supplied with available K<sub>2</sub>O and P<sub>2</sub>O<sub>5</sub>. The author summarizes his most important conclusions as follows:—Applications of (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub> to soil induced very marked increase in weight of crop and number of fruits. There was no significant difference in crop, however, between applications of 2, 4 and 6 lb. (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub> per tree. A leguminous cover crop did not increase the N content of the soil, or, accordingly, the size of crop. Applications of superphosphate, potassium sulphate and lime did not affect size of crop. The amount of out-season fruit was not affected by any of the treatments. The size of an in-season crop, however, shows a significant negative correlation with the following out-season crop. This can be explained on the basis of amount of nutritional reserves. Although applications of nitrogenous fertilizers caused an increased crop, the increase in tree size did not exceed that of the control, rather the reverse. Fruits from all plots of all treatments were analysed for P, K, Ca, N, ash, dry weight, sugar, total soluble solids, acid, thickness of rind and wastage due to mould. Correlations and partial regression coefficients were calculated for all factors before final conclusions were drawn. A high P content and probably also a high Ca content is associated with a low acid content. On the other hand, a high K content causes a high acid content. A high K content causes a thick rind of oranges, whereas a high P content induces a thin one. A high Ca content causes an increase in the amount of wastage due to mould during storage. Nitrogen has the reverse effect. None of the factors determined has any effect on sugar content except N, which increases sugar content with increased N content, and ash, which has a similar effect. Remarks similar to those for sugar apply to total soluble solids. The juice content of the pulp is not affected directly by any of the factors determined. There is a reciprocal relationship between P and N, and between Ca and N; there is also a direct positive relationship between K and N, and between K and ash. High N is positively correlated with high organic P, irrespective of the amount of total P present. High N is therefore necessary for synthesis of phosphatic organic substances.

723. CHEVALIER, G. 634.31-1.8  
 La fertilisation des orangeries algériennes. (The manuring of oranges in Algeria.)  
*Bull. Syndicat algérien Agrumes* 5, 1936, pp. 72.  
 The principles involved in the manuring of citrus trees are discussed in detail with special reference to Algerian conditions, and comprehensive mechanical and chemical analyses of some 20 soils in 4 regions of Algeria are tabulated. The following are some of the main points made:— Citrus fruits contain 13-14% dry matter and 0.3% minerals, and the three common nutrients are present in the average proportions of N 0.16%, P<sub>2</sub>O<sub>5</sub> 0.06%, K<sub>2</sub>O 0.25%, on a fresh fruit basis. A maximum yield of 200 quintals (20,000 kg.) under extensive cultural conditions plus the production of about 1,000 kg. new vegetative organs per hectare per annum utilizes approximately 50 kg. N, 15 kg. P<sub>2</sub>O<sub>5</sub> and 50 kg. K<sub>2</sub>O. Under intensive cultural conditions these amounts may have to be trebled. In estimating the quantities of fertilizers required to supply these amounts of NPK it is necessary to determine the quantities of each element available in the soil, the proportion of the soil mass explored by the root system of the trees, and the approximate proportions of each fertilizer that will be absorbed by the trees. Weeds must also be considered and to illustrate the importance of this factor a chemical analysis is given of a weed cover consisting principally of oxalis. The fresh weight of the weeds was nearly 27,000 kg. per hectare, the dry weight 2,210 kg., N 39 kg., P<sub>2</sub>O<sub>5</sub> 10 kg., and K<sub>2</sub>O 102 kg. Similar analyses are given for green manure crops consisting of (i) mustard, (ii) beans in flower, (iii) immature barley and (iv) a mixture of beans and barley, and also for composts made from grape residues, leaves of distilled geraniums, and olive husks. The amounts of nutrient elements in the soil which may be utilized by the trees vary considerably with the nature of the soil, but from results obtained in France and America the author estimates that on an average 0.5-1.0% N, 5% P<sub>2</sub>O<sub>5</sub> and 20% K<sub>2</sub>O will be utilizable. Similarly for organic manures the figures, which he terms "coefficients of utilization", are N 18%, P<sub>2</sub>O<sub>5</sub> 8% and K<sub>2</sub>O 10% while for inorganic fertilizers they are N 40-50%, P<sub>2</sub>O<sub>5</sub> 10-15% and K<sub>2</sub>O 10-25%. These figures allow for the fact that the tree roots cannot explore all sections of the soil in search of nutrients, and examples given here of methods employing the figures to calculate fertilizer requirements are based on mature, full-bearing trees, the roots of which have been estimated to tap roughly 4,000 metric tons of soil in the upper 60 cm. per hectare. The method outlined makes it possible to calculate approximately the theoretical yield of any particular grove. Examples are again given which show that if other factors such as water supply are satisfactory actual yields will approach these theoretical yields, but that, should the water supply be inadequate or the method of pruning, etc., unsuitable, the actual yields may fall far below those for which nutrients are available. In cases where it proves to be impracticable to determine the nutrient status of particular soils, a fertilizer formula of 8% N, 7% P<sub>2</sub>O<sub>5</sub> and 8% K<sub>2</sub>O is recommended for general purposes in Algeria. The amounts to apply should lie between 1 and 2½ metric tons per hectare, depending upon the age of the trees and density of the grove, and in addition adequate amounts of organic manure and irrigation water should be supplied.
724. BRICHET, J. 634.3-1.542  
 La taille des agrumes. (The pruning of citrus.)  
*Bull. Syndicat algérien Agrumes* 8, 1936, pp. 42.  
 In the absence of any comprehensive experimental work no definite rules can be laid down for the pruning of citrus, but in this paper the author discusses the general physiological factors involved in pruning fruit trees, and shows to what extent they may be applied in the case of citrus trees. The shoots borne on citrus trees may be divided into three main groups: (1) Fruiting shoots, which are slender, slow growing, generally horizontal or drooping and bear small leaves. It is normally desirable to leave these unpruned for 3-4 years, after which their fruiting capacity is apt to decline and it becomes desirable to replace them by younger shoots. (2) Vegetative shoots, which are erect, quick growing and bear larger, coarser leaves. After one or more seasons these normally bear fruit of rather inferior quality near the apex. This causes them to curve downwards and assume a horizontal position, and they then usually give rise to a succession

of further vegetative shoots which follow the same course. (3) Water shoots, which usually arise in the centre of the tree as a result of too drastic or ill-timed pruning. These should be removed as early as possible unless they are required to replace an old branch which has died. In shaping young trees a low stem is nearly always to be preferred to a high, and a hollow spherical form is much to be preferred to an open vase-shaped form. At this stage pruning should be confined as far as possible to the elimination of water-shoots, for, if it is too drastic, fruiting will be delayed. The same applies to the early fruiting years and it is not until the tree is 10-12 years' old that more detailed pruning becomes necessary. This takes the form of thinning out the centre of the tree to admit light and air and of cutting back outer branches bearing fruiting wood which no longer functions properly. In every case pruning should be moderate and repeated annually rather than drastic and performed only at intervals of several years. Comparatively severe pruning is best done in late winter or early spring to avoid the ill effects of suddenly exposing the internal parts of the tree to the summer sun or winter frosts. Rainy periods and the season of full blossom should also be avoided. Light pruning may, however, be done at almost any time during the year. The prunings should be removed and burnt or be ploughed or harrowed under in the grove. Some notes are included on the tools to be used in pruning, and on particular varietal characteristics which have to be taken into account when pruning navel oranges, Valencia-late oranges, lemons, and the mandarin and Clementine oranges.

725. WINSTON, J. R. 634.3-1.55 + 631.563.1  
**Harvesting and handling citrus fruits in the Gulf States.**

*Fmrs' Bull. U.S. Dep. Agric. 1,763, 1937, pp. 37.*

This bulletin, which supersedes *Fmrs' Bull.* 696, "Handling and shipping citrus fruits from the Gulf States", contains information on the following points:—Standards of maturity, organization for handling the crop, picking and forms of clippers, types of field box, and the removal of the fruit from the orchard to the packing house. A brief account is given of the principal forms of decay and methods of controlling them. Treatments, particularly with ethylene, which may be used to turn mature but green fruits yellow or orange, are described. The other packing-house processes which follow colouring, namely washing, drying, polishing, grading, sizing and packing are outlined. Among containers particular attention is paid to the standard Florida box and the half box, but it is also noted that the open-mesh bag in several sizes is being increasingly used as a container for both oranges and grapefruit. Transport by road, rail and water is also described and some notes are given on precooling and cold storage. Finally a short section is devoted to the special handling of limes.

726. WAHLBERG, H. E. 634.31-2.182-1.55  
**Citrus returns show value of wind protection.**

*Calif. Citrogr., 1937, 22 : 376.*

The summarized averages of the returns of 20 otherwise comparable protected and unprotected orange orchards showed \$445.45 per acre for the former against \$271.34 per acre for the latter. Other results were—Protected average yield 328 field boxes per acre, unprotected 214 field boxes; grades of protected fruit, 1st grade 117 packed boxes, 2nd grade 73, 3rd grade 20, unprotected fruit graded 54, 52 and 22 respectively. With lemons the returns were, protected \$536.89 per acre, unprotected \$324.64. Yield, protected 292 field boxes per acre, unprotected 197. Grades protected 63 boxes 1st, 63 2nd, 30 3rd, unprotected 31 1st, 43 2nd, 26 3rd grade fruit.

727. WEBBER, H. J. 634.3-2.111 : 634.62  
**Frost injury to citrus reduced by growth in date gardens.**

*Calif. Citrogr., 1937, 22 : 270-1.*

A temperature of 15° F. caused considerable injury to citrus growers in the neighbourhood of date plantations, but in combined plantations in which citrus was growing under large date palms the damage was greatly reduced. Possible reasons for this are discussed and the conclusion is reached that the withdrawal of water from the date gardens during harvesting may have had

some influence. It is mentioned in support that from 1-3 rows of citrus trees on either side of a windbreak are often less liable to frost damage and that this is probably due to the withdrawal of moisture and nutrients by the windbreak and to the greater dormancy and hardening thus caused. The reduced heat and light of the date gardens may also be favourable for a more rapid recovery.

728. LAFFOND, P.

634.3-2.1 + 2.3/4

Les maladies cryptogamiques et physiologiques des aurantiacées en Algérie.  
(**Parasitic and physiological diseases of citrus in Algeria.**)

*Bull. Syndicat algérien Agrumes* 7, 1936, pp. 69, bibl. 4.

The symptoms and treatment of diseases found to occur on citrus in Algeria are described in detail, and in the sections on control measures frequent reference is made to methods practised and the results obtained from experiments in the U.S. and Spain. [Only a few of these references, however, are listed in the bibliography. ED.] The diseases are grouped under the parts of the tree affected as follows :—*Diseases affecting the root system.* A. Physiological. (1) Asphyxiation and rotting of the roots. Preventive measures include the choice of permeable soil, drainage, irrigating at a distance from the trunks and shallow planting. Control measures include cultural practices designed to reduce moisture, draining, applications of lime and aerating the roots by removing the soil around the crown to a circle 80 cm. to 1 m. in diameter and 40-50 cm. in depth. *Diseases affecting the crown and base of the trunk.* Parasitic. (1) Gummosis caused by a species of *Phytophthora* as yet not identified with certainty. Of the various *Citrus* species, *C. Limonium* is the most susceptible, then *C. medica*, *C. sinensis* and *C. nobilis*. More resistant species include *C. triptera* (trifoliolate orange), *Fortunella japonica* and particularly resistant, *C. Bigaradia* (sour orange). (2) Collar rot caused by *Botrytis cinerea*. *Diseases affecting the trunk and main branches.* Parasitic. (1) A rot caused by several species of *Polyphorus*. (2) A gummosis caused by *Diplodia natalensis*. (3) Psorosis or scaly bark. (4) Mosses and lichens may easily be removed by painting or spraying the trunk and branches with a 10% solution of iron sulphate followed, after drying, by an application of 10% milk of lime plus 1% alum. *Diseases affecting the young shoots.* Parasitic. (1) Withering of shoots caused by *Diplodia natalensis*. (2) Melanose caused by *Phomopsis Citri*. (3) Anthracnose caused by *Colletotrichum gloeosporioides*. *Diseases affecting the foliage.* Physiological. (1) Lime-induced chlorosis. (2) Mottle-leaf or foliocellosis. (3) Gum stains which appear following a cold winter or after the use of certain sprays. B. Parasitic. Several minor diseases associated either with *Sphaerella gibelliana*, *Phyllosticta* spp. or *Septoria Limonum*. *Diseases affecting the fruit.* Physiological. (1) Oleocellosis or green spot. (2) Fruit cracking. Parasitic. (1) Blue and green moulds. The paper concludes with some notes on the preparation of substances used to disinfect or protect wounds.

729. AJON, G.

632.48 : 634.3

Studii sul malsecco degli agrumi. (**Studies on malsecco\* in citrus.**)

Reprinted from *Ann. Staz. Agrum. Frutt. Acireale*, 1937, vol. 14, pp. 136, bibl. 48.

The author has collected here under one cover eight articles written and published by him since 1930 on this most distressful condition of citrus trees known as "malsecco". He has made careful chemical analyses of sick and healthy trees and has studied the ratios of the different elements within different species of citrus; he has examined modern and ancient practice. All his findings are set out here. Each aspect is dealt with separately and he does not suggest any easy method of control. In brief he would appear to think that the only hope of overcoming the disease and its effects lies in more rational culture, in the use of more balanced manures and in the abandonment of attempts to get maximum returns at the expense of stamina. He notes moreover the existence of resistant varieties and stocks and considers every use should be made of them. Each article is interesting and suggestive in itself.

\* Referred to by Fawcett and Lee as the same as Citrus blast caused by *Bacterium citriputeale*, but now identified as *Deuterophoma tracheiphila*.—ED.

730. JONES, E. P. 632.752 : 634.3  
**The bionomics and ecology of red scale—*Aonidiella aurantii* Mask.—in Southern Rhodesia.**

*Annu. Rep. Mazoe Citrus exp. Sta. for 1935\**, 1936, pp. 11-52, bibl. 8.

(1) The present study was undertaken in order to solve the problem of controlling red scale on the young non-bearing citrus trees and also to determine how the insect is influenced by the climatic conditions that exist in Southern Rhodesia. (2) The economic importance of the pest is discussed. In the study of its life history the following points of interest were determined. Red scale is viviparous, only rare instances of a so-called ovoviparity being found; parthenogenesis does not occur. In development a slower rate of growth was shown by individuals growing on leaves than on fruit; apart from a nutritional cause, it is possible that this is due to a difference in the eco-climates, as a higher day-degree requirement is shown by individuals growing on leaves. The threshold of development and the thermal constant as determined from the data at Mazoe are given and compared with those obtained in California and Palestine. Productivity and the factors governing it are fully discussed and the length of adult life and the sex ratio are dealt with. (3) Temperature is the predominant factor in development and in determining the percentage settlement of the crawlers, though the latter is controlled to some extent by relative humidity. The function of relative humidity is more apparent in productivity and is almost as important as temperature in controlling the rate of production, the duration of the production period, and the total number of young produced. (4) The number of generations in the year varied, numbering five or just over in the shade, and six and a partial seventh in direct sunlight. Natural mortality was much higher in the winter than in the summer and was generally higher during the third stage of development. (5) The Chalcid parasite, *Aphytis chrysomphali*, Mercet, and the various Coccinellid predators are of no economic value in affording a control. (6) An economic control should result, provided an efficient oil spray be found, by spraying the young trees in the winter, at the same time as the neighbouring trees are fumigated, and by giving an additional application in September when the first summer generation has reached its maximum proportion. (7) Seven figures and one plate are included. [Author's summary.]

731. COSTANTINO, G. 632.944 : 634.3  
**Le fumigazioni cianidriche degli agrumi. (HCN fumigation of citrus groves.)**  
*Boll. Staz. Sper. Agrum. Frutt. Acireale* 66, 1937, pp. 100, bibl. 70.

The author not only deals very thoroughly and clearly with HCN fumigation of citrus, but also gives useful descriptions of 10 important citrus scales which are known to do damage in Sicily and Calabria, detailing what is known of their life histories and any special points touching their control, particular mention being made of predators or other counter parasites known to help in their control. He gives details of the American "cyanogas" and the German-made "calcid" and their use and then considers at some length the method of fumigating by means of gas released from cylinders containing liquid HCN. Although the fumigation has been found to be excellent when so carried out, the care necessary in dealing with the cylinders would appear to preclude any general use being made of the method. He next examines and explains very carefully the normal process recommended in Southern Italy. This consists essentially of the release of gas by the interaction of cyanide of sodium, sulphuric acid and water. The whole process is described from beginning to end and copious notes are given on every possible contingency including the avoidance of damage to different citrus species, first aid to the gassed, etc.

732. BLACKMON, G. H. 634/5  
**A resume of the work of the horticultural department. [Florida.]**  
*Citrus Ind.*, 1937, 18 : 7 : 6-7, 19.

Mention is made of a few of the more important problems under investigation by the Horticultural Experiment Department of Florida. With vegetables the work centres round phenological studies and the testing of varieties, the effect of various green manure crops on growth,

\* Being *Publ. Brit. S. Afr., Co.5.*

yield and quality and a study of fertilizer placement and requirements. *Perilla*, an annual plant whose seeds produce a drying oil now much imported, is being investigated. *Perilla ocyoides* made the greatest growth and *P. nankinensis* produced the most seed. With citrus in storage iodine-impregnated papers used with moisture-proof coverings have largely controlled stem-end rot. In refrigeration research the outstanding results have been the development of methods and equipment for holding fruit both for short periods and for longer periods of 2-5 months. Methods, now successfully used in commerce, have been developed for the production, cool storage and distribution of an orange juice indistinguishable from the fresh product even after 10 days' storage. By 1936 the Florida tung-oil production was the heaviest on record. Bronzing of the leaves was found to be a deficiency trouble easily rectified by zinc sulphate applied to the soil or sprayed on to the foliage. It is claimed that this alone has led to the planting of hundreds of acres. The application of zinc has also controlled trenching or chlorosis in citrus and rosette in pecans and black walnuts. In nutritional experiments with single and cluster type tung trees the cluster types have usually borne heavier crops, but both require fertilizers for maximum production. In pecan culture it has been shown that there is considerable difference in varietal response to soils, climates, etc., and that a given prolific variety may be profitable in one district while hardly returning the cost of the fertilizers in another. An economical cover crop and fertilizing programme for pecans has been evolved. Cold unground pecan kernels under 12 tons pressure gave 25-36% of the kernel weight of a clear golden oil which appears to have many possibilities as a cooking oil while the residue after expression made a good butter. In connexion with gas fumigation experiments a portable gas analysis instrument has been developed and is proving of great value.

733. OINOUE, Y. 634.51-1.535.6 : 577.15.04  
Einfluss der Kohlenhydrate und des Stickstoffes auf die Keimung des Wurzelstecklings von *Diospyros kaki* L. var. Koshyu Hyakume. (Influence of carbohydrates and nitrogen on the growth of root cuttings in *D. kaki*.) [Japanese, German summary.]

*J. hort. Ass. Jap.*, 1936, 7 : 205-6.

The author found that the growth of root cuttings of Japanese persimmon, *Diospyros kaki* (var. Koshyu-Hyakume) was weakened by spraying with solutions of grape sugar or raw sugar. Both organic and mineral nitrogen were tried, the best results following the use of the ammonium salt.

#### TROPICAL CROPS.\*

734. LESTER-SMITH, W. C. 631.45  
Soil erosion.

*Trop. Agriculturist*, 1937, 88 : 92-107.

This paper consists of a summary of the Report of the Committee on Soil Erosion (Sessional Paper III of 1931) and has been compiled at the suggestion of the Executive Committee of the Central Board of Agriculture, Ceylon. An important feature is the illustrated description of various more or less effective systems for the prevention of erosion on hillside plantations.

735. EDWARDS, W. H. 632.7 + 632.951  
Insecticides to control insect pests in Jamaica.  
*Bull. Dep. Sci. Agric. Jamaica* 6 (n.s.), 1936, pp. 50.

This bulletin contains information on methods of preparing and applying a number of sprays, poison baits, fumigants and deterrents, and on the materials which should be used to control the chief insect pests of the following plants:—Avocado, banana, beans and peas, beetroots, cabbages and other cruciferous plants, cannas, citrus, coconuts, coffee, cucumbers, melons and pumpkins, egg plant, lettuce, mango, strawberry, sweet potato, tobacco and tomato.

\* See also 688, 700.

736. HARGREAVES, E. 632.78

**Fruit-piercing Lepidoptera in Sierra Leone.**

*Bull. ent. Res.*, 1936, 27 : 589-605, bibl. 15.

Fruits affected by fruit-piercing Lepidoptera in Sierra Leone include grapefruit, sweet orange, mandarin, tangerine, sweet lime, cashew, mango, bread-fruit and jak-fruit... The present study refers principally to citrus varieties. Lists of species observed to be attacking fruits and of larval food plants in Sierra Leone and a list of fruit piercers observed in other countries are given, together with descriptions of the life-history and habits of the following moths:—*Othreis divitiosa* Wlk., *O. fullonica* L., *O. materna* L. and *Achaea catocaloides* Guen. The effect of piercing citrus fruits was studied by making punctures in the rind with stainless steel pins. The depths of the punctures  $\frac{1}{2}$ ,  $\frac{3}{4}$  and 1 in., covered the range of proboscis lengths inserted by most of the species. The piercing was done in the field at the end of July on both oranges and grapefruit and by the end of October 10 out of 12 fruits punctured once to a depth of 1 in., 9 out of 14 fruits punctured to  $\frac{3}{4}$  in. and 6 out of 14 fruits punctured to  $\frac{1}{2}$  in. had fallen compared with 2 out of 40 fruits left unpierced. A number of fungal organisms were found to have developed on fruits pierced by the moths and on a series pierced artificially. Experiments with light traps and poisoned baits have shown the former to be useless. Baits containing arsenical or fluorine compounds with Demerara sugar or honey as the attractant appear to be more promising, but experiments to determine their comparative efficiency have yet to be made.

737. GEORGI, C. D. V. AND OTHERS. 632.951.1

**Variations in toxicity of some races of *Derris elliptica*.**

*Malay. agric. J.*, 1937, 25 : 187-200, bibl. 6.

Wide variation in toxicity (i.e. in rotenone content and/or ether extract) has been found to exist in samples of *Derris elliptica* from different parts of Malaya. Degrees of toxicity are not influenced by change in environment, though they are by the age of the plant. Certain types of *D. elliptica* were established at Serdang and Kuala Lumpur and the roots analysed when the plants were 24 months old. The actual figures and comparisons are presented in a number of tables. Of those tested Changi No. 3 showed superior toxicity and a narrow frequency of variation, while it is more easily established on inland soils and less liable to attacks by insect pests. The race, however, is not widely established and is unpopular with growers owing to the non-fleshy nature of the roots, though this does not in any way detract from their toxicity or value for export. Attention is drawn to *D. elliptica* var. Sarawak creeping which has an ether extract equal to Changi No. 3 though a lower rotenone content. This plant may prove satisfactory for cultivation on a commercial scale. Clones selected for yields, rotenone content and ether extract are being established for the purpose of studying inter- and intra-clonal variations.

738. MILSUM, J. N. AND GEORGI, C. D. V. 632.951.1

**Derris cultivation in Malaya.**

*Malay. agric. J.*, 1937, 25 : 239-45, bibl. 7.

An account is given of the methods of growing and preparing derris for market in Malaya.

739. NUTMAN, F. J. 633.526.1

**Agave fibres\*. II. Mechanical qualities.**

*Emp. J. exp. Agric.*, 1937, 5 : 93-111, bibl. 2.

Methods developed at Amani for testing the mechanical qualities of agave fibres are described. The test portion for breaking strain of the hank has been standardized as lying 20-30 cm. from the butt end thus including most of the short fibres. The size of a sample for routine testing has been fixed at from 600-1,000 fibres. The considerable difficulty experienced in obtaining effective randomization of the sample owing to the adhesive nature of the fibres was overcome by placing the fibres in a cylindrical jar arranged to rotate for 4 hours with its axis horizontal at a speed just below that at which the fibres are pressed against the side of the jar by centrifugal

\* Part I. Morphology, histology, length and fineness; grading problems. *Ibidem*, 1937, 5 : 75-92, H.A., 1937, 7 : 182.

force. The tensile strength tests are carried out on a locally made machine, the principle of which is briefly described. At the end of each test the following information is available for each of 6 sub-samples : (1) Weight in milligrams of the bundle ; (2) the number of fibres in the bundle ; (3) the average breaking-strain in grams ; (4) the frequency of distribution of the breaking strains. From these data are calculated (a) the fineness of fibres (b) the breaking-strain, and (c) the breaking-length (i.e. the length of fibre which, if held up by one end, would break under its own weight). From the testing of samples from various localities it is tentatively suggested that the properties of the fibre are correlated with the district producing it. The results and figures arising from the examination of certain randomized samples of fibre are discussed under the following heads : relation between fineness, breaking strain and cross-sectional area of fibre ; relation between the age of plant and strength, length and amount of fibre produced by a leaf ; elasticity and ductility of sisal fibres. A plan and elevation are given of the apparatus used for measuring elasticity and ductility.

740. EVANS, H. 633.61 : 581.144.2  
**The root system of the sugar-cane. IV. Absorption and exudation of water and mineral substances.\***  
*Emp. J. exp. Agric.*, 1937, 5 : 112-24, bibl. 3.

By making concurrent determinations of the total quantity of the most important substances in stools of virgin or plant-crop sugar cane it was possible to investigate the relationship between absorption of mineral substances and root development and also gain information on the influence of dry conditions on the functional activities of the roots. The results of an investigation of the exudation of water and mineral substance by several cane roots are given and their bearing discussed on the problems associated with the intake of water and mineral substances by the different types of sugar cane root. The bearing of the results on certain aspects of the practical agriculture of sugar-cane are briefly discussed.

741. ALLEN, O. N. 633.689-1.56  
**Taro and its fermented product poi.**  
*Food Manuf.*, 1937, 12 : 80-2, bibl. 2.

The taro plant (*Colocasia esculenta*) and its fermented product, poi, is staple food in many parts of the tropics, though less used than formerly. The method of preparing poi and biological processes involved in the fermentation are described. Attention is called to the extreme digestibility of taro starch. Vitamins A and B, but not C and D, are present in appreciable amounts in both taro and poi. Attempts to establish a market outside the habitat of the plant have so far not been very successful. Experiments in canning show that poi can be sterilized without difficulty at various stages of fermentation.

742. CHAKRAVARTY, J. N. 633.72  
**Report on tea culture in Assam for the year 1935.**  
*Publ. Assam Dep. Agric.*, 1936, pp. 11.

This report covers the following :—Number of gardens, area under tea, total area of estates, labour employed, character of season, output, prices, demand for tea seed, scientific enquiry, statistics.

743. LEACH, R. 633.72-1.531  
**Tea seed management.**  
*Bull. Dep. Agric. Nyasaland* 14, 1936, pp. 16.

In Nyasaland tea seed to be planted at stake would have to be stored from March/June until November/December, when the rainy season begins. Hitherto successful storage has proved difficult. The two essential factors for success for storage in bulk are the maintenance of sufficient humidity to prevent the seed from drying out and the prevention of condensation of water

\* Part I. *Ibidem*, 1935, 3 : 351-62, *H.A.*, 5 : 689. Parts II and III, *Ibidem*, 1936, 4 : 208-20, 325-31, *H.A.*, 6 : 893.

on the surface of the seed. The method recommended, after experiments which are described, is to store well matured seeds, collected preferably directly off the trees, in roofed-over pits dug in soil. A pit 3 ft. x 1 ft. x 18 in. deep will hold 140 lb. of seed. A layer of sand 1 in. thick and covered with grass is placed over the seed, the latter being kept slightly moist. It is important to remove the grass outside the pit before watering it. An increased rate of germination is obtained by drying the seed in the sun (for one day only in Nyasaland). The straightest roots are obtained by planting the seed with the hilum (eye) on the side except with germinated seed where the root has emerged from the testa more than  $\frac{1}{2}$  in., in which case it must always be planted in the direction in which the root is pointing.

**744. EDEN, T.** **633.72-1.8**

**Selected notes on the manuring of tea.**

*Bull. Tea Res. Inst. Ceylon* 16, 1936, pp. 20.

These notes are gathered from recent addresses by members of the Ceylon Tea Research Institute to District Planters Associations which have been published regularly in the Tea Quarterly [and noted in *Horticultural Abstracts*—ED.]. The results obtained by 6 years manurial experiments are summarized. Nitrogen is the chief yield promoter in tea, the response being in direct proportion to the amount applied. The percentage of nitrogen recovered in new growth by the plant from artificial manures amounts only to under 20%. No difference has been found between yield capacity of organic and inorganic manures. Potash has never increased yield, but has improved quality. The beneficial effects of phosphoric acid are limited to doses up to 30 lb. per acre. Recovery from pruning is apparently governed by the reserves in the plant and not by the manures applied when the bush is without foliage. To provide full benefit manures should be applied early in the pruning cycle. It is shown that an ideal C/N ratio for purposes of plant nutrition can be provided by turning in the leguminous green crops dadap (*Erythrina lithosperma*) and *Tephrosia Vogelii*, and the pruning leaf of tea, and that the cost and trouble of composting the loppings merely to produce the same result is unwarranted. Other organic materials, however, produce different and less desirable C/N ratios and these are tabulated. The best means of conserving nitrogen in the soil, in circumstances where it is an economic proposition, is by green manuring or composting.

**745. TUBBS, F. R.** **633.72**

**Investigations on the planting, pruning and plucking of the tea bush.**

*Bull. Tea Res. Inst. Ceylon* 15, 1936, pp. 59.

This bulletin is a progress report of the researches on various physiological problems affecting tea carried out since 1930 by the Tea Research Institute of Ceylon. That it is bad economics to continue planting tea on those portions of the estate where it does not really do well is pointed out. Such places would be better used for the production of fuel wood. The different methods of transplanting supplies to the plantation and the subsequent attention to be given to them is discussed, as are the pruning of young tea and the operations involved in the various types of pruning. Evidence suggests that a long cycle will result in continued improvement of quality but that there will be a fall in the crop yield towards the end of the cycle. This will necessitate heavier manuring. The effects of the seasonal conditions in Ceylon are discussed. The importance of considering the carbohydrate supply when deciding on the method of pruning is pointed out. At the lower elevations it is essential to leave a sufficient area of foliage on the pruned bush to assist recovery. Finally tipping and plucking are dealt with at some length,

**746. KENYA COLONY, SENIOR COFFEE OFFICER.** **633.73**

**Coffee investigational work (for 1936).**

*E. Afr. agric. J.*, 1937, 2 : 431-9.

The rainfall, 40.68 in., was 3.32 in. above the average for the past eleven years, nevertheless the coffee produced was generally inferior and the trees showed considerable debility. This is attributed to the fact that the fall was unduly low in those months when it is of most importance to the growth and maturation of the fruit. The results of the monthly pruning experiments

(i.e. the influence of time of pruning on time of flowering and yield) are briefly noted for each month and show no difference from those of the preceding year. At the end of the season multiple stem trees carrying a heavy crop showed no distress while single stemmed trees carrying an equal or less crop were much debilitated. Multiple stemmed trees also show less berry mottling and more even ripening. Methods of converting mature single into multiple stemmed trees or of establishing the latter from seed are described. Pruning versus no pruning resulted for the unpruned trees in inferior new bearing wood growth, a ragged appearance and a less heavy and smaller bean, while the liquor was decidedly inferior. The benefits of regular bordeaux spraying are clearly shown by the experiment plot yield records and by the healthy appearance of the sprayed trees in contrast to the controls and by the percentage of clean coffee produced. Comments are made on the behaviour of certain varieties and local selections. The importance of mulching in the drier districts is stressed to the point of advising the reduction, if need be, of the coffee area in order to grow elephant grass to provide the mulch. The author considers that this practice would, in the drier districts, turn many an unremunerative plantation into a profitable one. The question of shade and shade trees needs further work. The supposed deleterious effect on the quality of coffee of fermentation in cement tanks was examined. In new cement tanks where lime is present in the form of calcium carbonate experiment showed that lime lengthened the time of fermentation and produced a definite taint. Confirmatory experiments on a factory scale in which other kinds of tanks were included were most inconclusive, as were quality experiments in drying on trays of various materials. Taint can also, apparently, be caused by the inclusion of greenish or yellow tinted beans. These discolorations are most apparent when the parchment is wet and therefore somewhat transparent. The cause is at present unknown. In vegetative propagation work 13 different rootstocks are being tested. *C. eugeniooides* as a stock has a dwarfing effect combined with early cropping. The success of grafting on the nursery seedling stock varied with the time of year and the material, September proving the best month and commercial *arabica* types the easiest stock to graft. In field grafting unsuspected difficulties are being overcome. Cuttings in the solar propagator proved less successful than last year probably because of a new experimental rooting medium. The only successful method of obtaining clonal material on its own roots is by ringbarking and etiolating sucker growth. The resulting plants of 1932 now bear good crops with large even beans and have a vigorous habit of growth.

747. STOFFELS, E.

633.73

La sélection du cafier arabica à la station de Mulungu. (Premières communications.) (*The selection of arabica coffee at Mulungu. Progress report.*)

*Publ. Inst. nat. Étude agron. Congo belge, Sér. sci., 11, 1936, pp. 41, bibl. in text.*

Observations were made in 1935 on a group of 1,757 *arabica* plants belonging to a local variety called Mibirizi. The plants were divided into two lots, those with brown-leaved terminal shoots (BB) and those with green-leaved terminal shoots (BV), and their yields were compared. In both cases frequency distributions for yields were of an extreme asymmetrical form, the largest number of individuals being found in the lowest yield class. This is considered to be due to the lack of balance existing in the plants between generative and nutritional phenomena, whereby many plants tend to overbear at an early age and subsequently suffer from die-back and produce little or no crop. Environment was also shown to have a marked effect upon the extent of the variation between individuals when the area was divided into 4 plots, but, whether each plot was considered separately or the area considered as a whole, the coefficients of variability for yields of the BB plants were always much lower than those for yields of the BV plants. From this it is concluded that the BB plants are less subject to overproduction and die-back than are the BV plants. Similarly observations have shown that the BB plants are less subject to black tip than are the BV plants [see also abstract 749.—ED.]. In this connexion it is of interest to note that it has been estimated that at least 35% of the trees planted at Kivu fail as a result of die-back and black tip. The inheritance of the brown- and green-leaved terminal shoot characters was also studied. Eight introduced varieties and 26 out of 33 lines of local varieties proved to be homozygous with regard to this colour character as well as to other

morphological characters associated with leaves, stems and internodes. Seven lines of Mibirizi, on the other hand, showed a 3 : 1 segregation for leaf colour in the F<sub>2</sub> progeny, but whether BB or BV was dominant depended on whether the mother tree was BB or BV. Few of the progeny of BB lines proved subject to black tip, but among the BV lines there was only one which was not affected by the disorder. The fact that the great majority of the different types of *arabica* growing at Kivu proved to be homozygous with regard to the characters studied suggested that self-fertilization is the general rule in *arabica* coffee, and experiments are described which showed that this was in fact the normal process. Finally a study of the beans indicated that, although these exhibited little variability, their size might be improved by selection.

748. LEROY, J. V. 633.73-2.7  
Observations relatives à quelques insectes attaquant le cafier. (Observations on certain coffee pests.)

*Publ. Inst. nat. Étude agron. Congo belge, Sér. sci., 8, 1936, pp. 30, bibl. 5.*

The morphology and life histories of six coffee pests found in the Belgian Congo are described, together with an account of the injury they cause and methods of control. They include three species of *Epicampoptera* (*Lepidoptera*), namely *E. marantica* Tams., which has been found infesting *robusta* coffee to a serious extent, *E. vulvornata* Hering, n.sp., which occurs less commonly on the same coffee, and *E. andersoni* Tams., which occasionally attacks *arabica* coffee. The other three pests are *Leucoptera coffeella* Guer. which is to be found in all coffee plantations in the Belgian Congo but usually does little damage, *Stephanoderes hampei* Ferr., regarded as the most serious pest of *robusta* coffee in the Congo, and *Pseudococcus lilacinus* Ckll., the mealy bug. Insects found to parasitize, or to be predators of, each of these pests are mentioned in the sections on control measures, and in the case of the mealy bug particular attention is paid to methods of eradicating ants which help to spread the pest and drive away its natural enemies and to the breeding and liberation of predaceous coccinellid beetles, notably *Chilocorus angelensis* Crotch.

749. JURION, F. 633.73-2.19  
Résistance au climat des cafiers arabica du type brun. Étude préliminaire.  
La brûlure des cafiers. (Effect of climate on the brown-leaved type of *arabica* coffee. Preliminary study. Scorch of coffee bushes.)

*Publ. Inst. nat. Étude agron. Congo belge, Sér. sci., 6, 1936, pp. 19, bibl. 10.*

The name "brûlure" (scorch) is preferred to the terms "black tip" and "hot and cold disease" used in Kenya, etc., since the factor primarily responsible for the disorder it denotes is the sun. The trouble is usually found only in coffee bushes grown at relatively high altitudes, and the only known remedy is the planting of shade trees. Studies were carried out at the Nioka experimental station, where scorch is very prevalent, and are described in this paper in two main sections. 1. *Direct causes of the disorder and the effect of shade.* Evidence is presented which shows that low temperatures are not the sole cause of the disorder and that shade trees do not raise the temperature of the night air around the coffee bushes. The opinion expressed elsewhere that the fall in temperature in the evening is responsible is also disputed. The observations at Nioka indicate that the air continues to cool throughout the night until about 6 a.m. when there is a sudden rise in temperature, and it is this sudden warming of the cooled plants which results in scorch. The following process occurs:—At sunrise rapid evaporation of water takes place from the cool, dew-covered leaves and this lowers the temperature of the leaves still farther. As the sun's rays gain power the temperature of the leaves rises suddenly, producing effects in the tissues similar to those which occur when a rapid thaw follows a frost. Thus the cells first become desiccated under the influence of cold and then transpire very freely under the influence of the sun. This leads to loss of turgor and the tissues scorch and die. Shade reduces scorch by making the change in temperature less sudden. In rainy periods it reduces condensation during the night and hence also the evaporation of water in the early morning, and in dry periods it causes the temperature to rise more slowly and thus allows the water which has passed out of the leaf cells through the influence of cold to be reabsorbed by the

cells. 2. *Factors contributing to the presence of scorch.* *Altitude.* Plantations at altitudes of 2,000-2,100 m. are very subject to scorch, as are plantations in valleys at 1,650-1,750 m. By contrast plantations at altitudes of 1,800-1,900 m. or less, but not situated in valleys, are rarely troubled by scorch. *Aspect.* At Nioka trees on western slopes have been most subject to scorch, but where conditions are less favourable to the disorder it is generally trees on eastern slopes which are most affected. *Cultural practices.* Applying manure and removing weeds and mulching them round the trees resulted in improved general health of the trees but not in reduction of scorch. *Soil.* Preliminary indications are that soil has no effect on scorch. *Variety, and type of arabica coffee.* This is undoubtedly the most important factor affecting appearance of scorch. It has been found in Kenya that types which produce brown-leaved young shoots are, if not immune, at least very resistant to scorch, whereas types which produce green-leaved young shoots are rapidly destroyed by scorch. The possibility that this difference might be due to the brown leaves retaining heat better than the green was examined, but leaf-temperature records did not show at all conclusively that brown leaves remained appreciably warmer during the night than did green leaves. It has been observed that during warm periods the leaves on trees with brown shoots droop much earlier than do those on trees with green shoots, and investigation has shown that this tendency to wilt is associated with greater transpiration from the brown than from the green leaves. Thus the brown-leaved types which are immune to scorch are more susceptible to drought than are the green-leaved, scorch-susceptible types. On a basis of these results the author puts forward a hypothesis to explain the greater resistance of the brown-leaved types to scorch, and this theory is to be the subject of a subsequent study.

750. HARDON, H. J. AND NEUTEBOOM, J. D. 633.841-2.19-1.4  
 Resultaten van een gedetailleerd fysisch onderzoek van pepergrond op Banka. (Results of an investigation of physical properties of pepper soils under field conditions in Banka.) [English summary, pp. 1½]  
*Landbouw*, 1936, 12 : 246-66, bibl. 14, reprinted as *Korte Meded. alg. Proefst. Landb.*, 19.

The authors describe investigations made on pepper soils with a view to determining the cause of the so-called yellow disease of pepper. They conclude from them that the soil structure is to blame. The soil in both cases is granitic in origin and may be described as a greyish-yellow sandy lateritic soil low in plant nutrients. Both in the surface and in the subsoil of the diseased plot there was a smaller average pore space and a larger amount of water present than in the healthy plot. Manuring with burnt soil is found to improve the soil structure but its effects vanish after a few years. It is suggested that a leguminous green manure crop might be helpful. [From authors' summary.]

751. RHIND, D. 633.88  
**Betel-nut in Burma.**  
*Agric. Surv. Burma* 25 of 1936, pp. 15, bibl. 15.

Following a short account of the part played by the betel-nut in the history of Burma, the author proceeds to describe the palm, *Areca Catechu*, and its cultivation and uses under local conditions. The tree is described. Its fruit is found in two shapes, round (*Oh-baung*) and oblong (*Chiwin*), but it is doubtful if these are distinct varieties. The fruit of *A. triandra* is sometimes substituted for that of *A. Catechu*, but this species is only found wild. Cultivation, the preparation of nurseries, and transplanting are outlined. Yields should rise to a maximum of 150 nuts per palm at 20 to 28 years old, which on an acre basis should give a crop of 1,450 lb. or a little more. Harvesting takes place, generally in 3 pickings, from October to December. In preparing the nuts the first stages are husking and dividing the nuts into 3 or 4 grades. Subsequent treatments, such as drying, washing, boiling, etc., depend upon the grade of the nuts and also vary in different districts. Sections are also devoted to costs, imports and exports, possible areas of extension, the pests and diseases of betel-nut palms, and the chemical composition of the nuts. By-products of the betel-nut palm include the paper-like linings of the leaf-sheath known collectively as *phet*.

Three grades of *phet* are recognized, their uses being as cheroot wrappers, stoppers in the butt-ends of cigars and the upper layer of the soles of Burmese slippers. The husk is not considered to be of any value in Burma. The only use of the nut locally is as a masticatory, together with betel leaf, lime and cutch.

752. FERRAND, M. 633.912-1.522/541  
La multiplication de l'Hévéa brasiliensis au Congo belge. (*Propagation of rubber in the Belgian Congo.*)

*Publ. Inst. nat. Étude agron. Congo belge, Sér. tech., 6, 1936, pp. 34, bibl. 16.*

Past experience has shown that the soil and climatic conditions of the Belgian Congo are highly suitable for the growing of *Hevea* rubber, and it is also considered that in the low cost of manual labour this country possesses a great advantage over the East Indies. Until recently the main difficulty in establishing a successful rubber industry in the Congo has been the complete lack of selected, high-yielding clonal material. This deficiency has now been remedied by the I.N.E.A.C., which has obtained and multiplied the best East Indian selections. In the present paper the establishment of nurseries, the budding of *Hevea* and the transplanting of the budded plants to their permanent positions are described in detail. The following are some of the points made by the author :—The first 10 months are occupied in establishing a nursery and in raising stocks to buddable size from seed sown in special seed beds. The seedlings are best planted out in double rows, obtained by spacing the rows alternately 35 cm. and 50 cm. apart. The method of vegetative propagation used is shield budding, and a well-trained native propagator is capable of inserting with ease 125 to 150 buds a day. When good, well-ripened budwood, full of sap, is used, and the buds are grafted on to 10- to 16-month-old stocks, equally full of sap, about 70% of them should unite. Budding should not be done during dry periods, but it is also desirable following rain or heavy dew to wait until the stocks have dried thoroughly. One metre of budwood provides about 12 suitable buds. The buds are inserted just above the soil level and are wrapped for preference with paraffined cotton bands. These bands should be loosened, but not removed, 10 days later, if the weather has been moist, or 14 days later, if it has been dry. 6-7 days after this the stock is cut back and about 3 weeks later the buds start to grow. In 2 months, at least 75% of the buds which have united should have started growing. To be on the safe side twice as many grafts should be made as will ultimately be required for planting out. The plants should be transferred to their permanent position in the plantation when the buds have just turned green and made several millimetres of growth. In the course of this operation all small lateral roots should be removed leaving only the tap root. In planting the soil should be rammed down firmly, and the plants covered with some leafy branches for the first 8-10 days. During the next few months lateral shoots forming on the main stem are removed, and a crown should not be allowed to form until the trees are about 2 metres high.

753. MURRAY, R. K. S., AND OTHERS. 633.912-2.421.1  
*Oidium leaf disease.*

*Bull. Rubb. Res. Scheme Ceylon 53, 1936, pp. 23, bibl. 11.*

This paper includes the report of a committee appointed to enquire into the whole position regarding oidium leaf disease of rubber and its control, and also a report of the control of the disease on a small rubber estate during 1936. In the latter report it is noted that, generally speaking, sulphur dusting has given beneficial and sometimes striking results.

754. MILLER, C. D. AND OTHERS. 634.1/8 : 581.192  
*Some fruits of Hawaii. Their composition, nutritive value and use.*

*Bull. Hawaii agric. Exp. Sta. 77, 2nd edit. 1937, pp. 133, bibl. 75.*

The composition and food value of 25 fruits grown in Hawaii are discussed. Simple recipes for preparing these fruits for table are given in great variety, e.g. 16 for banana alone, and should ensure for the bulletin a popularity not usually attained by scientific publications.

755. TERRA, G. J. A. 634.1/7 : 551.56  
 Eenige gegevens over klimaat en groei vruchtdracht van vruchtboomen.  
 (Some data on the influence of climate on growth and yield of fruit trees.)  
 Reprinted from the Rep. 15e Vergadering v.d. Vereeniging van Proefst-personeel,  
 Batavia, October 1935, pp. 117-140, bibl. 27.

In this paper are discussed climatic conditions most favourable to the growth and yield of certain common tropical fruit trees, chiefly in relation to their performance in the different districts of Java. The amount and periodic distribution of the rainfall are the principal factors involved.

756. PAUL, W. R. C. AND GUNERATNAM, S. C. 634.441-1.541.5  
 The propagation of the mango in Jaffna. I.  
*Trop. Agriculturist*, 1937, 88 : 86-91.

A method of budding mangoes in the nursery for which much success is claimed has been devised at the Farm School, Jaffna, Ceylon. The stocks used are seedlings, 6 months to 1 year old, and budding is done at a height of about 10 inches from the ground, at a point where the bark is brownish or greyish in colour, the most suitable time being during a growth flush. To prepare the stock 2 parallel vertical cuts in the bark 1½-2 inches long are joined at the top by a horizontal cut. The flap thus cut is pulled gently down, leaving a patch of the cambium surface exposed. The bud, taken from the current season's growth and with the petiole removed except for a stub of 1/10 in., is cut so that it remains in the centre of a shield about 1-1½ in. in length and of an area slightly less than that of the prepared patch. The cut is made so that a wedge of wood remains underneath the shield. The shield is then placed in the centre of the patch on the stock plant in such a manner that its sides or extremities do not touch the edges of the patch. The flap is now pulled up over the bud, the whole being secured with waxed tape. In hot weather a bud is protected by a strip of dry plantain sheath 3 × 5 in. tied on the stock above and below. During wet weather the bud is covered with oil paper. After 2-3 weeks the tape is unwound and, if the bud is still green, it has probably united. The plantain sheath is replaced. A week later this covering is removed and the stock is ringbarked 1½-2 in. above the bud, the final cutting back of the stock taking place when the bud has grown to a length of 3 or 4 in.

757. SWYNNERTON, R. J. M. 634.57  
 The oyster or Kweme nut.  
*E. Afr. agric. J.*, 1937, 2 : 444-6.

The oyster nut is the name given to the seed of *Telfairea pedata*, a climbing gourd-bearing plant indigenous to eastern Africa. The nuts are used for confectionery and medicinally among native mothers. The kernels contain, amounting to 60% of their weight, a yellowish oil of the non-drying class, whose fatty acids include stearic, palmitic, telefairic and an unidentified hydroxy-acid. The oil saponifies readily. The oil cake could probably be used as stock feed and should be valuable for cows in milk. There is at present no regular market, but an experimental consignment of nuts to Europe in 1936 sold at the rate of £100 per ton and resulted in brisk enquiry for further supplies. European planters in the western Usambara Mountains have now their first commercial plantations in bearing. The main difficulty has been the expense of the wattle poles used in the construction of the necessary trellis. This will be greatly reduced when the wattles now being grown for the purpose on the plantations are ready. The seed is sown *in situ* in double rows 4 yards apart and with 2 yards between seeds. The space between each double row is 30 yards, the plants being trained outwards on the overhead trellis to meet and finally interlace, with those of the adjacent double rows. The plant is dioecious so that a large proportion of males have to be cut out. Weeding soon ceases to be necessary as the shade cast by the plants controls them.

758. PAUL, W. R. C. AND CANAGARATNAM, C. 634.573  
 The production of cashew nuts in Mannar.  
*Trop. Agriculturist*, 1937, 88 : 6-11.

Mannar is a small island off the coast of Ceylon producing some 250,000 lb. of cashew nuts annually. The groves of 1 to 2 acres each are on sandy soils, mostly unfit for other crops; the

plant, however, will not support a brackish sub-soil water. The seed is germinated in small baskets or in shaded nursery beds from nuts dried in the sun from 10 to 14 days. Fresh nuts are considered to produce weaker seedlings. Shade is removed after the seedlings have made 3 or 4 leaves and they are transplanted in August, a month or so after germination, by which time they have made 4 or 5 leaves. On non-sandy soils special planting holes filled with good compost have to be prepared. Planting distances vary, but a suitable final one is 40×40 ft. with a preliminary spacing of 20×20 ft. for the first 7-10 years. Yields become sizeable after 3 years. Of the several varieties the medium sized nuts giving about 60 to the lb. are most desirable, large sized nuts often having inferior kernels. Selected varieties are now under trial. The primitive methods of roasting the nuts are described. In view of the heavy demand for extracted kernels in Europe and U.S.A. the industry, at present a cottage one, should have a profitable future. At the moment finance is the limiting factor.

759.

BEIRNAERT, A.

634.6 : 581.142

Germination des graines d'*Elaeis*. Essais entrepris à Yangambi. (**Investigations carried out at Yangambi on the germination of oil palm seeds.**)*Publ. Inst. nat. Étude agron. Congo belge, Sér. tech., 4, 1936, pp. 38, bibl. 11.*

Seeds of the *dura* and *macrocarya* types of oil palm which have thick or very thick shells start to germinate under natural conditions 5 to 8 weeks after sowing and show 60 to 70% germination after 6 months. By contrast, thin-shelled seeds of the *tenera* type do not start germinating until about 14 weeks after sowing and only show 30 to 50% germination at the end of 12 months. The study reported here was undertaken to determine the factors causing this slow and irregular germination in the thin-shelled seeds and to discover means of encouraging quicker germination. The factor which is considered to be entirely responsible for the trouble is the lack of protection afforded to the kernel by the excessively thin and porous shell. The seed is thus exposed to alternate desiccation and moistening and to harmful variations in temperature, and as a result not only is its physiological maturation delayed, but the phenomena associated with the development of the embryo occur over a prolonged period. In order to get such seeds to germinate fairly rapidly optimum conditions are necessary at all times. The three conditions found to be important are the maintenance of a constant temperature between 30° and 35° C., a constant moderate humidity and adequate aeration. Three methods of heating the seeds to the required temperature were studied:—(1) The seeds were placed in chambers of several types heated by means of open fires, pipes, etc.; (2) the seeds were put in warm water; and (3) the seeds were placed in hot-beds either in the form of fermentation pits or of fermentation frames. The first two methods did not give consistently satisfactory results, but treatment for 1 month in the fermentation frames stimulated germinative capacity sufficiently to obtain 60% germination at the end of 6 months. In this system the seeds are sown in lidded boxes which are placed on a layer of fermenting vegetable matter covering the bottom of the frames. Crushed charcoal proved to be a better medium in which to sow the seeds than did soil or sand. After germination has started the seedlings may either be transplanted one by one as each germinates, or all the seeds, whether germinated or not, may be removed to propagating beds in the open when a germination of 10 to 15% has been recorded. Of these systems only the second is regarded as practicable, and attention was, therefore, paid to the form of propagating bed as affecting the germination of the remaining seeds. With the seeds planted 3-4 cm. below the surface, the best media proved to be pure sand, and very sandy soil with or without added charcoal. Less sandy soil proved inferior. The use of glass covers on the propagation beds gave better results than leaving the beds uncovered, but is considered to be too costly to be practicable. A light covering of dried grass, however, also proved beneficial and this practice is recommended. Under these conditions moderate watering every 2 or 3 days gave much better results than did more frequent watering. Ants were found to be very troublesome in certain cases and among various methods of control tested only trapping combined with the digging of trenches around the beds proved effective. Experiments were also made to determine if germination might be stimulated by means of chemicals, but the results do not appear to have been very conclusive.

760. BELGRAVE, W. N. C. AND LAMBOURNE, J. 634.61  
**Experiments on the cultivation and manuring of coconuts in Malaya.**  
*Malay. agric. J.,* 1937, 25 : 179-86, bibl. 3.  
The investigations conducted on 6 estates confirm the conclusions reached in previous years\* that with trees from 10-20 years old no economical increase of yield can be expected from liming or manuring and the present records, taken over 6 months in 1936, show that there had been no delayed action.
761. NIXON, R. W. AND CRAWFORD, C. L. 634.62-1.542.14  
**Fruit thinning experiments with Deglet Noor dates.**  
*Proc. Amer. Soc. hort. Sci. for 1936,* 1937, 34 : 107-15, bibl. 9.  
The results of experiments carried out in 1934 and 1935 in Coachella Valley, California, are presented. In the first year treatments consisted of no thinning, light and heavy thinning at the time of pollination and heavy thinning on 1 June. In the second year they consisted of light, moderate and heavy thinning a few days after pollination. The results show that size of dates increased in proportion to the severity of thinning, although this effect was reduced when thinning was delayed. With no thinning the crop was very slow to ripen, many dates showing a tendency to mature imperfectly and shrivel prematurely. Thinning accelerated ripening, moderate more so than light, but heavy thinning had only slightly more effect on the time of ripening than had moderate thinning. The physiological disorder "checking" or "blacknose" was increased in proportion to the amount of thinning regardless of the time of thinning. Hitherto, the only factor known to contribute to the appearance of this disorder was the occurrence of humid conditions at a certain stage before ripening. The results obtained in the present experiment indicate that the physiological condition of the date at the time the humidity occurs is also an important factor. A total reduction at the time of pollination of about 50 to 60% of the dates per bunch gave the best results. In thinning up to this point the reduction in the number of dates was offset by increased fruit size with a large proportion of higher grade fruit and a decrease in the proportion of culls. Thinning beyond this point was attended by an excessive increase in the amount of blacknose and reduced yields without any compensating advantages.
762. REYPENS, J. L. 634.771  
**La production de la banane au Cameroun. (The production of bananas in the Cameroons.)**  
*Publ. Inst. nat. Étude agron. Congo belge, Sér. tech.,* 7, 1936, pp. 23.  
The history of the comparatively new banana industry of the Cameroons is outlined and a map is provided which shows the present distribution of plantations in both the British and French mandates. Information is also given on climate and soils, and on the methods of propagation, cultivation and marketing practised. The following are some of the points made:—The Cameroons possess a somewhat limited area of black volcanic soils which are very suitable for bananas. The only variety grown for export is the Gros Michel. In plantations run by Germans cultural methods are fairly standardized, whereas in French areas few definite rules are followed. On the other hand the French have organized a very efficient and rapid transport service for the shipment of bananas to France. This service includes inspection and rejection of stems that are below standard. The Germans turn their waste fruits into dried "banana figs", a product for which there is a market in Central Europe but not elsewhere. The process of producing "banana figs" is briefly described. The bananas from British plantations are marketed in Hamburg.

\* *Ibidem*, 1934, 22 : 511-7, H.A. 4 : 653.

763. SMART, H. P. 634.771-2.48  
**Sigatoka leaf disease of bananas.**  
*Leaf. Dep. Agric. Br. Honduras* 3, undated\*, pp. 7, bibl. 2.  
 This disease, caused by the fungus *Cercospora Musae* Zimm., common in Indo-Malayan and Australian regions, has only recently been recorded in the Western Tropics. Symptoms consist in the appearance of indistinct, light brownish-green linear markings lying parallel to the veins of the leaf. They increase slightly in size and dry out, forming dark brown to black linear-oblong or elliptic areas up to  $\frac{1}{2}$  in. in length and a third of this in width. In British Honduras the spots attain much larger size and the dark brown spots are sometimes accompanied by a characteristic yellow transitional zone. The leaf blade is destroyed, the petiole weakens, breaks down and hangs down at the junction with the stem, the plant being badly defoliated. The plant stands with immature fruit bunches, though, if the fruit is fairly advanced, accelerated ripening occurs. In British Honduras, contrary to what appears to be experienced elsewhere, the rate of spread and intensity is greatest in the more fertile areas where the plants show greatest vigour and the disease is also increased by the greater light and aeration attendant upon the opening up of a plantation. The best controls so far are bordeaux 5 : 5 : 50 or lime-sulphur 1 part of concentrated solution to 40 water applied at 10-14 days interval.
764. MITCHELL, R. S. 634.771-2.48  
**Stem end rot of bananas with special reference to the physiological relationships of *Thielaviopsis paradoxa* (De Seynes) Von Höhn.**  
*J. Coun. sci. industr. Res. Aust.*, 1937, 10 : 123-35, bibl. 11.  
 The symptoms and economic importance of stem-end rot of Cavendish bananas (*M. Cavendishii* Lam.) in Australia are discussed. It was not possible to determine the source of infection either in the plantation or on alternate hosts. Comparison with strains of *T. paradoxa* from other sources indicate that in Australia, the banana strain constitutes a distinct variety.
765. OLDS, G. D. P. 634.774  
**Further experimental work on pineapples.**  
*Malay. agric. J.*, 1937, 25 : 38-57.  
 A record of experiments and results obtained from April 1931 to September 1935 in the investigational work of the Pineapple Experiment Station, Singapore. (1) *Manurial experiment*. Of 11 treatments all except 3 gave greater yields than the control, the two most effective being sulphate of ammonia 100 lb., superphosphate 100 lb., sulphate of potash 200 lb. per acre and a similar treatment but with half the amount of potash. There was a definite response to the application of phosphates. The lowness of the yield per acre, compared with that of other countries is attributed to the wider spacing used here. (2) *Planting distance*. The only result of value was a significant increase in numbers of fruit in the closer planted plots. Soil variation disguised other results. (3) *Cultural treatment*. Pabco paper mulch gave significantly greater results than clean cultivation or no weeding, mulching with pineapple refuse from factory waste or forking once per annum. (4) *Green manure*. Pineapples were planted after one and after two similar crops of green dressing had been grown and turned in. The whole area had been dressed with  $\frac{1}{2}$  cwt. sulphate of ammonia, 3 cwt. basic slag and  $\frac{1}{2}$  cwt. sulphate of potash per acre before the first sowing. No significant difference was found between the 6 different green manures grown, but in every case the single dressing produced markedly better results than the double dressing. Possible reasons for this are discussed. (5) *Variety trials*. The Ruby (probably synonymous with the Singapore or Malayan Canning pineapple) and the Sarawak (variation of Smooth Cayenne of Hawaii ?) are the two most promising for commercial exploitation as their leaves are non-spiny, and labourers greatly dislike working among the spiny varieties. (6) *Close planting*. The planting layout was bands of 4 rows with the plants 2 ft. apart each way, diagonal planting, and 5 ft. between the bands. Manurial treatment was 300 lb. superphosphate, 100 lb. sulphate of ammonia, 100 lb. sulphate of potash at the rate of 500 lb. per acre. General

\* Received April 1937.

growth and vigour were continuously good, and a noticeable feature was that soil erosion was restrained. The manured plots did not show any considerable increase over the unmanured. The yields of over 5 tons per acre approximated to those usual on commercial Malayan pineapple estates. Close planting resulted in thinner fruit stalks which were not always able to bear the weight of the fruit. (7) *Selection*. The small size, deep eyes and number of seeds common to the local canning fruit are disadvantages to be eliminated if possible. Parent plants are also selected for freedom from spines, pests and diseases, for fruit of large, cylindrical, even shape and medium length, with crown sucker small, single and non-spiny and suckers below the fruit well developed. (8) *Revised manurial experiment on closely planted pines*. This is designed to show the upper economic limit of fertilizing and is still in progress. (9) *Cross fertilization trials*. Cross fertilization between the Sarawak and the Singapore Canning pine has produced a quick-growing hybrid possessing many desirable features. (10) *Stem slice method of propagation*.\* This method consists of planting cross sections of the young developing stem of the pineapple plant, each containing 2 or 3 dormant buds, after dipping the slices in a weak solution of potassium permanganate. Smooth Cayenne yielded up to 60 per cent. germination. (11) *Ferrous sulphate spraying*. Contrary to experience in Hawaii spraying the plants with a 5% solution of ferrous sulphate monthly from June to December produced no beneficial results. (12) *Drying suckers prior to planting*. This had no effect in reducing spininess contrary to a belief prevalent among Chinese planters. (13) *Investigations of the fruit characteristics of the Singapore Canning pineapple*. The two colour variations commonly found, one (the pale yellow) being unsuitable for canning, proved difficult to separate. It is still uncertain whether the types are botanically distinct or whether soil conditions are responsible for the variations. (14) Some miscellaneous minor investigations chiefly relating to disease are briefly noted.

766. COLLINS, J. L. 634.774 : 575.24  
**A frequently mutating gene in the pineapple, *Ananas comosus* (L.) Merr.**  
Reprint from *Amer. Nat.*, 1936, 70 : 467-76, bibl. 7.  
Data are presented from a study of Cayenne and hybrid populations which relate to the origin and genetic nature of the chimera and spiny plants that appear in populations of the vegetatively propagated, smooth-leaved Cayenne variety of pineapple.

#### STORAGE.

767. MALLISON, E. D. AND OTHERS. 664.85.11 : 656  
**Protection of apples and pears in transit from the Pacific Northwest during the winter months.**  
*Tech. Bull. U.S. Dep. Agric.* 550, 1937, pp. 54, bibl. 25.  
Experiments on the protection of apples and pears from freezing while in transit by rail from the Pacific Northwest to New York during the winter have been carried out during two periods totalling in all 14 seasons. In the first period covering 1917 to 1922, inclusive, the aspects studied were:—(1) various types of heaters burning kerosene, charcoal, hard coal and alcohol, (2) car construction and equipment, including floor racks, bulkheads, bulkhead openings and insulation in car walls, (3) a method of supplying heat through ducts built in the floor, and (4) special heater cars. During this period 14 transport tests using a total of 87 cars and 1 stationary test were made. The second series of experiments was carried out from 1927 to 1935 with the following objectives:—(1) to test modifications of charcoal heaters, (2) determine the effect of operating heaters according to temperature conditions inside the car, (3) determine the need for, and test means of, preheating cars, (4) equalize temperatures throughout the load by forced-air circulation, and (5) determine the conditions under which ventilation should be given. In addition, experiments were made to determine the effectiveness of (1) various supplementary insulating materials placed inside the car and around the load, and (2) the latent

\* A full description of this method is given on p. 20 of *Tech. Comm.* 7, *Vegetative propagation of tropical and sub-tropical fruits*. Imperial Bureau of Fruit Production, East Malling.

heat of water as a means of preventing or retarding the freezing of fruits in transit. During this period 21 transport tests, using a total of 130 cars, and 1 stationary test were made. The present paper is concerned principally with the second series of tests, but information obtained from the earlier investigations is also summarized. The results have in general shown that there is a need for improvement in the methods used in transporting apples and pears from the Pacific Northwest during the winter months, and have indicated some of the means of achieving this. Under the present system, which is known as the Carriers' Protective Service, heaters in the cars are lighted and extinguished according to the temperature of the air outside the car. It was found that with this method temperatures inside the cars could not be satisfactorily regulated. The principal recommendation, therefore, is that the heaters should be operated by a system of "inside control", whereby heat should be released when the minimum temperature of the air inside the cars falls to slightly above the freezing point of the fruit. The amount of heat released should be just sufficient to prevent freezing injury, but as this would at present necessitate frequent inspection of the heaters the development of an automatic or thermostatically controlled heater should be encouraged. The results of the other individual experiments are discussed in detail.

768. PAINTER, A. C. 664.85.22.037  
**Notes on one season's experience with cold storing plums.**  
*Annu. Rep. East Malling Res. Sta. for 1936, A20, 1937, pp. 288-94, bibl. 2.*  
 Observations were made on plums of the following varieties: Victoria, Giant Prune, Pond's Seedling, Cambridge Gage, Warwickshire Drooper and Cluster Damson. Results showed that fruit picked when firm and beginning to colour kept better than fruit picked when more mature and that delay in storing after picking lessened storage life. Costings indicate that the cost of storing per 12 lb. chip amounted to about 4d. The storage temperature averaged 35° to 37° F. and the periods of storage varied from a fortnight to 25 days.
769. WORMALD, H. AND PAINTER, A. C. 632.42 : 664.85.22.037  
**Further observations on brown rot of plums in cold storage.**  
*Annu. Rep. East Malling Res. Sta. for 1936, A20, 1937, pp. 198-200.*  
 Most of the wastage from rot noted in stored plums in 1936 at East Malling was found to be due to *Sclerotinia fructigena* and *S. laxa*, particularly the former. It is suggested that excessive wastage can be avoided by sanitary measures in the orchard, i.e. removal and burning rotten and mummified fruits, and the use of uncontaminated baskets and trays when storing the fruit.
770. SAMISCH, R. M. 664.85.31.035.1  
**Observations on the effects of gas storage upon Valencia oranges.**  
*Proc. Amer. Soc. hort. Sci. for 1936, 1937, 34 : 103-6, bibl. 2.*  
 Freshly picked Valencia oranges were stored at 32°, 36°, 45° and 70° F. in tanks through which the following gases were passed:—(1) Air, (2) nitrogen containing 1% oxygen, and (3) a mixture of air and carbon dioxide (18-22% CO<sub>2</sub>). Examination after 3 months' storage showed that about half the fruits kept at 70° F. had rotted from *Colletotrichum* infection and a few from *Penicillium*, there being no significant differences between infections occurring under the different gas treatments. Some rotting also occurred at 45° F. but none at 32° and 36° F. CO<sub>2</sub> treatment resulted in sunken spots and, in extreme cases, in brown sunken areas at the distal end of the fruit. This injury was most marked in the oranges stored at the higher temperatures. The flavour did not appear to be materially affected by CO<sub>2</sub> treatment. Nitrogen, on the other hand, produced no visible injury, but produced a disagreeable flavour. The pulp and peel of the fruit were also subjected to chemical analysis, but since only small differences in change of composition were found between the edible portions of the fruits kept in different gaseous environments, it is concluded that gas storage would seem of minor practical importance for oranges. By contrast the storage of oranges at low temperatures had no detrimental effects and proved very effective in checking decay.

## PROCESSING, FRUIT PRODUCTS.

771. GURNEY, E. H. 581.192 : 634.1/7  
**Composition of some fruits and fruit waste.**  
*Qd. agric. J.,* 1937, 47 : 403-5.

Tables of analyses are given of the composition of Queensland-grown fruits taken from samples already ready on the market. The fruits dealt with are plums, cherries, peaches, apricots, bananas, mangoes and others. Analyses are also given of the waste parts such as skins, stones, etc.

772. KASSAB, M. A. 664.85 + 664.84  
**Preservation of fruits, vegetables and pickles.**  
*Leaf. Minist. Agric. Egypt, hort. Sect.,* 42, 1936, pp. 8.

Four or five lines each are devoted to instructions for canning green peas, green okra, beans, asparagus, artichokes, vine-leaves, spinach and tomatoes, for pickling green olives, cucumbers and other vegetables, and for making mango chutney. The preservation in cans or bottles of grapes, pears, mangoes, plums, apples, strawberries and peaches is similarly outlined.

773. EIDT, C. C. 664.85.11.047  
**Principles and methods involved in dehydration of apples.**  
*Mimeograph Dep. Agric. Canada,* undated (? 1937), pp. 30.

This comprehensive and detailed account of the principles and the actual process involved in the efficient dehydration of apples in Nova Scotia should prove of the greatest value wherever apples have to be disposed of otherwise than on the fresh fruit market. The author deals with the subject under the following heads:—*Fruit requirements for economic production and quality*:—varieties—these vary in suitability according to flesh colour, dry ratio, etc. ; size of apple—large being preferred to small as being easier to peel in bulk ; condition of fruit ; *mechanics of dehydration*—dehydrators versus evaporators—the former are more economical in operation, cleaner and when steam is used offer less chance of fire, they also produce a superior final product ; principles of dehydration, physical conditions of atmosphere ; *commercial dehydrators*—double and single tunnel types and the loading thereof—the single tunnel type, properly operated, is preferred and it is found that hot end loading in the single short tunnel using an additional finishing chamber is most efficient ; general information on construction ; other factors which include storage, wasting, paring and coring, slicing, sulphuring, curing and screening. The photographs and diagrams given add greatly to the value of a most useful article.

774. BARGER, W. R. 634.62 + 664.85.62.047  
**Experiments in hydrating dry Deglet Noor dates.**

Reprinted *Rep. 13th annu. Date Grs. Inst.*, 1936, pp. 14-6.

A considerable part of the 5,000,000 lb. Deglet Noor date crop is too dry to be sold as fresh or cured fruit. Usually those not used for the manufacture of by-products are hydrated and softened and marketed as whole fruit. The present process is to hold the fruit in a hot humid room until softened, the humidity being maintained and the temperature kept at 130° F. by the intermittent injection into the room of live steam. The paper gives the results of experiments in which these dry dates were hydrated by a steam process and also in atmospheres at temperatures of 100°, 80° and 34° F., with high and low relative humidities. The inversion of cane sugar in the dates was accelerated by the absorption of moisture by the fruit, being most rapid at high humidity and temperature and least at 34° F. and low humidity. Steam hydration or high humidity with a holding temperature of 100° F. changed in 8-10 days these cane sugar dates to fruit in which invert sugar predominated. At holding temperatures of 80° and 34° F. inversion was slow enough to allow the absorption of sufficient moisture to soften the fruit before the invert sugar increased to as much as half of the total sugar. It is concluded that the control of colour and syrup formation by low temperatures is probably impracticable owing to the length of time needed to soften the fruit. The data, however, suggest the possibility of combining hydration and storage for the part of the crop that is not marketed immediately and the possibility of starting hydration at low temperatures in order to shorten the time necessary

to complete the process in the steam room and thus reduce the time of exposure to temperatures responsible for undesirable darkening and syrup formation.

775. CHILD, R. 634.61 : 658.8  
**Ceylon estate copra.**

*Trop. Agriculturist*, 1937, 88 : 137-49, bibl. 19.

Analyses have been carried out on 52 representative samples of Ceylon Estate No. 1 copra, all but four received from 7 estates in the course of one year. The other grades recognized in the Colombo sales rooms are Estate No. 2 and No. 3 and mixed (F.M.S.). The general average composition was moisture 6·8, oil 63·7%, oil (dry basis) 68·3%. The figures are compared with recorded results for 62 samples of Malayan Estate copra which averaged moisture 6·9%, oil (dry basis) 65·6%. The difference of oil percentage is attributed partly to the slower process of drying used in Ceylon and partly to an unexplained fundamental difference between the nuts of the two countries. No variation of oil content or composition with time of plucking or estate situation could be detected. Improvement in the preparation of white copra is desirable, since under a sales method initiated in 1936 quality superior to No. 1 Estate will make an increased price.

776. COOKE, F. C. 634.61 : 658.8  
**Copra manufacture. Part III.\* Large copra kilns.**

*Malay. agric. J.*, 1937, 25 : 93-106.

The lower efficiency of the Ceylon type of copra drying kiln when used in Malaya is attributed to the absence of definite dry seasons in the latter country. The preliminary period of sun drying used in Ceylon is also found to render the kiln drying more effective and to allow of a greater number of nuts being dried at one time. In describing the Ceylon type of kiln the movements of hot air and the process of drying on the kiln are also explained and it is shown that the difficulty lies in the uneven distribution of the heat, resulting in uneven drying of the load. The causes of conflagrations (eliminated in the smaller kilns described in previous articles\*) which can do considerable damage are enumerated and the various effects of about 17 high temperatures on drying copra is stated. With careful attention to loading and firing and a minimum delay in splitting the nuts and heating a high percentage of superior copra can be obtained on the Ceylon type kiln in Malaya.

777. CHARLEY, V. L. S. 663.813  
**Commercial production of fruit syrups.**

*Food Manuf.*, 1937, 12 : 192-5, bibl. 1.

Some account is given of the difficulties involved in the production of a pure fruit juice syrup which will maintain the characteristic fruit flavour. The intentionally high requirements of National Mark Scheme introduced at the request of intending manufacturers as a measure of protection against inferior products are given in some detail. The regulations make it clear that the juice content of the syrups under the Mark will be as high as possible. Some recent remarks of Mr. Paget Norbury are quoted to show that outside the National Mark there is nothing to prevent a manufacturer making a synthetic or semi-synthetic product labelling it "Genuine fruit juice" or "Prepared fruit juice" and that this is done. Experiment showed the necessity of keeping a high sugar content in the syrup without preservatives in order to retain the characteristic flavour, but a 65° Brix syrup is too sweet. In further experiments, the results of which are just to hand, 45° Brix syrups made from strawberry, black currant or cherry had lost a good deal of their flavour while a 30° Brix strawberry syrup was unrecognizable. Raspberry and loganberry were also affected, though to a less degree. The ideal sugar concentration seemed to be about 50%. Strawberry juice maintained in an unfermented condition for 11 months by Sertz E. K. filtration completely lost its characteristic flavour. The fruit juice of black currants proved to be the richest source of vitamin C, while strawberry juice also contained important

\* Part I. *Ibidem*, 24 : 167-76, H.A., 6 : 413 and Part II. *Ibidem*, 24 : 332-9, H.A., 6 : 971 deal with small and medium sized kilns respectively.

though lesser quantities. Among actual figures given are Baldwin black currants 161 vitamin C mg./100 c.c., strawberry Royal Sovereign 52.9. Although full data of the retention of ascorbic acid by the syrups are not available, there is reason to think that it is considerable.

778. ATKINSON, F. E. 663.3

**A home cider press.**

*Publ. Canad. Dep. Agric.* 530, being *Circ.* 112, 1936, pp. 8.

A small cider press to convert cull and surplus apples into cider is a definite necessity, but the smallest commercial presses at present available are too large and expensive for the purpose. In this paper the construction of a small home-made press, capable of extracting about 6 gallons of cider at each pressing (from 4 bushels of apples), is described in detail with the aid of diagrams.

779. DURHAM, H. E. 663.3

Recherche et dosage des métaux lourds dans le cidre.\* (A method of testing cider and similar liquids for heavy metals.)

Reprinted from *Bull. Ass. Chim.*, February 1937, No. 2, pp. 3.

The method here detailed consists of the precipitation of the metal with an excess of potassium ferrocyanide, completed by the addition of flocculating agents. The metals present in the precipitate are determined by normal gravimetric or colorimetric methods. The advantages of the method and certain precautions are detailed.

780. DURHAM, H. E. 663.3

Technique pour le dosage des acides volatiles du cidre et d'autres boissons.\* (The estimation of volatile acids in cider and similar liquids.)

Reprinted from *Bull. Ass. Chim.*, April 1937, No. 4, pp. 3.

The principles of the method advocated consist in raising the boiling point during distillation, the promotion of rapid ebullition and the avoidance of scorching the contents of the flask. Details are given and certain precautions are noted.

781. CHARLEY, V. L. S. 663.813

Investigations on fruit products. IX. Chemical constituents of fresh juices from single varieties of soft fruits and the suitability of the juices for syrup manufacture.

*Annu. Rep. Long Ashton Res. Sta. for 1936*, 1937, pp. 207-12, bibl. 3.

The results of chemical analysis of the juices of several separate varieties of English-grown soft fruits are tabulated. The vitamin C content of black currant juice was found to be three times that of lemon juice, strawberry juice contained an amount equal to that of lemon juice, red currant about 80% of that figure. Other juices gave lower figures. The varieties of the fruits tested which gave the most attractive syrups are noted.

782. CHARLEY, V. L. S. 663.813

Investigations on fruit products. X. The commercial production of fruit syrups.

*Annu. Rep. Long Ashton Res. Sta. for 1936*, 1937, pp. 213-30.

The author deals with the first year's operations at the factory set up by H. W. Carter & Co. at Ashton Gate, Bristol, where he was in technical control of the first season's processing. *Fruit supplies.* Difficulty was encountered in getting sufficient fruit at a reasonable price. It is suggested that the solution of the problem may lie in the organization of a system for the pooling and collection of any small bulks of fruit that may become unsaleable for the fresh fruit market from time to time. *Fruit condition.* It is essential that fruit should be practically free from mould. A certain amount of fermentation is not harmful. The fruit must be ripe and with its full colour. *Factory processes.* Milling in a grater mill similar in type to that now commonly used for cider making reduced the fruit to a mash. It is suggested that the thickness of the stainless steel cylinder surface should be increased from  $1\frac{1}{8}$  in. to  $1\frac{3}{8}$  in. or  $1\frac{1}{4}$  in. Fermentation

\* Paper given at the III Congrès Int. techn. et chim. des Ind. Agric. Paris.

and removal of pectin follows and notes are made of the following steps or phenomena in the processing :—juice extraction, jelly formation, juice clarification, juice stabilization, syrup filtration and bottling. *Characters of the syrups.* With regard to stability of the products no trace of fermentation was noted in raspberry, loganberry or black currant syrups and some slight trouble with strawberries was rectified early in the season. The reasons for the loss of clarity in most of the syrups after a lapse of time are discussed. Flavour was extremely satisfactory. There are indications that excessive fermentation in the milled fruit lead to the introduction of subsidiary flavours and tend to mask the true fruit character. It was possible to sell all the syrups made under the National Mark. Some of the syrups were acidified to 1·5% citric acid by weight and were then mixed with soda water. A remarkable retention of true fruit character was noted.

783. SINGH, L. AND LALL, G. 635.64-1.56  
**Studies in the preservation of fruits and vegetables. An investigation on the methods of preparation and standardization of tomato ketchup.**

*Publ. Fruit Prod. Lab., Punjab agric. Coll., Lyallpur*, 1936, pp. 15, bibl. 5.

Supplies of cheap, local tomatoes are very plentiful in the Punjab during May to mid-June and are also available during April, November and December. The study described here has resulted in the evolution of a formula for preparing a tomato ketchup that compares favourably with well-known foreign brands, and which should, if manufactured on a commercial scale, be able to compete without difficulty with the imported product. The process of manufacture is described in detail.

784. JOACHIM, A. W. R. 668.533.2  
**The present position of the trade in Ceylon citronella oil.**  
*Trop. Agriculturist*, 1937, 88 : 108-111, bibl. 1.  
EDITORIAL.  
Citronella.  
*Ibidem*, pp. 135-6.

In view of falling prices the question of improving the quality of the oil of citronella grass (*Cymbopogon nardus* vars.) grown in Ceylon is considered, and especially whether the Java variety locally known as "maha pangiri" and found to yield a high percentage of geraniol should be cultivated for the purpose. It is shown that Java and Ceylon oils are used for different purposes and do not really compete. The Java grass requires a richer soil than is commonly available in Ceylon and more intensive cultivation than growers there could give. It is shorter lived and must be less frequently harvested than the predominating Ceylon grass, "lena battu". The small difference in present prices would be more than counterbalanced by these difficulties. Furthermore, the Java oil being used for a limited high-class market, any great increase of output would reduce prices. The Ceylon oil need only pass the prescribed f.a.q. test (fair average quality); on this it is either accepted or rejected. There is no grading, and adulteration within reasonable limits is permissible, since a pure Ceylon oil commands no higher price, but the oil must pass Schimmel's test. Sale of Ceylon oil on a geraniol basis is unpracticable and unnecessary. The main line of work suggested is the improvement of quality by selection, cultivation and manuring.

#### NOTES ON REPORTS.

785. KOSTINA, K. F. 634.21  
**The apricot.** [Russian, with 6 page English summary issued separately.]  
*Supplement to Bull. appl. Bot. Genet. Plant Breed.*, Leningrad, 83, 1936,\*  
pp. 292, bibl. 618.

A detailed study of the literature and of herbarium collections has shown that the general area of distribution of wild species of the genus *Armeniaca* Juss. lies in the temperate zone of Asia

\* English summary dated 1937.

between 133° and 70° E and between 52° and 30° N. The distribution of the cultivated apricot in, and the export trade in dried and canned apricots from, the principal apricot-growing countries of the world is also noted. In the U.S.S.R., which possesses a larger apricot acreage than any other country, there are three main centres of production. The most important of these is in the Central Asiatic republics which produce, in gross output, more apricots than all the other regions of the U.S.S.R. combined, and possess a virtual monopoly in the production of dried apricots for shipment to other parts of the U.S.S.R. The principal varieties grown in this area for drying and for consumption as fresh fruit are noted. The second apricot area is found in Armenia, Daghestan and to some extent in Azerbaidzhan and eastern Georgia. The surplus crop in this area is canned. Quite different varieties occur here. The third apricot area is situated in the steppe zone of European U.S.S.R., and here the varieties grown are mainly of European origin, such as Red Cheek, Ananas (Peach), Hungarian, Ambrosia, Luizet and, to some extent in districts very subject to cold winters, seedlings of these varieties. As a result of preliminary studies of local and introduced varieties it has been found possible to distinguish 3 main ecologic-geographical groups of *Armeniaca vulgaris* Lam.:—(1) The Turkestan group, (2) the Iran-Caucasian group, and (3) the European group. The principal characteristics of each of these groups are described. The chemical composition of a number of these varieties has been investigated and the results indicate that European types are generally characterized by considerably higher acidity than varieties belonging to the other two groups. The latter, particularly the Turkestan varieties, contain higher saccharose contents (over 50% of the absolute dry weight), and, unlike the European types, possess the property of becoming saccharified when dried. The proportion of the dried product to the fresh fruit has also been found to be considerably higher in the Turkestan than in the European varieties. A list is given of varieties found to be most suitable for drying. Canning qualities have also been investigated in several areas, different named varieties being found best for the purpose in different districts. With regard to the breeding of new varieties it would appear that the main problems might best be tackled along the following lines:—(1) Most of the desired characteristics in apricots, such as fruit quality, canning and drying quality, etc., can be obtained by selection from the progeny of intervarietal crosses within the limits of the one species *Armeniaca vulgaris*. (2) With certain other characteristics such as increased winter hardiness, immunity to disease and a considerably later blossoming season, which become important if apricot-growing regions are to be extended northwards, it would seem necessary to utilize other species of apricots and produce hybrid varieties. The species which would appear to offer most promise in this direction are the hardy Siberian and Manchurian species, *Armeniaca sibirica* (L) Lam., *A. Davidiana* Carr., *A. mandshurica* (Max.) Skv. and natural hybrids of these species with the common apricot, and the disease-resistant Japanese and Chinese species, *A. Mume* Sieb. and *A. Ansu* (Max.) Kost. The common apricot, particularly when used as the pollen parent, has also been crossed successfully with Japanese plums and Hansen's hybrid plums and with *P. domestica* and *P. cerasifera*, and intergeneric hybridization along these lines is considered to offer another promising means of tackling the problem of raising new varieties. [From English summary.] [Attention is drawn to the very extensive bibliography—Ed.]

786. BRITISH SOUTH AFRICA COMPANY.

634.3(058)

*Annu. Rep. Mazoe Citrus Experiment Station for 1935,\* 1936, pp.*

VII-XII and 74, bibl. a few references in each section.

The report is divided into 5 parts† in which the work of the different sections is reviewed. I. *Superintendent's report.* The 1935 crop was below average in quality and quantity. The poor quality was probably due to a dry spell of some 7 weeks during the rainy season. This peculiar season was followed by an unusually severe winter, a grass temperature of 32° F. or lower being recorded on 29 mornings. Abnormal rain in March resulted in a flush of blossom,

\* *Publ. Brit. S. Afr. Citrus exp. Sta.*, 5.

† For Section III. The bionomics and ecology of red-scale—*Aonidiella aurantii* Mask. see abstract 730.

little less than that of the spring flush, and necessitated the expenditure of a great deal of labour on the removal of out of season blossom and fruit. The abnormal weather resulted in a lower average juice content of the fruit and hence, after culling to conform with regulations, a lower export of fruit. Prospects for the 1936 crop are considered. II. *Entomological review*. This includes notes on the incidence and control of red scale (*Aonidiella aurantii* Mask.), thrips (*Scirtothrips aurantii* Faure), cotton boll worm (*Heliothis obsoleta* Fabr.), aphis (*Aphis tavaresi*, del G.), soft scale (*Lecanium hesperidum* L.), and red locust (*Nomadacris septemfasciata*, Sert.) IV. *Chemist's progress report*. Soil losses have been made good in certain areas by the removal of soil from low lying groves, where it had accumulated in excess of need, to the denuded areas. Some 112,000 tons have been shifted in this way. Response to this soil renovation was quick. Irrigation has now been standardized on the estate in its most important aspect, namely, the establishment of an adequate moisture reserve under the tree drip with each application of water. Basin as opposed to furrow irrigation has been more widely adopted, one of its advantages being the facility of water control and the retarding effect on the drift of silt from the top end of the lead to the bottom. Such soil, moreover, as is moved is not lost from the grove but tends to bank up in each basin. There is no evidence on the estate of a beneficial effect of cover crops. An increasing amount of manure is being made annually and it is hoped soon to be able to supply each tree with 100 lb. yearly instead of with very heavy dressings occasionally. More use is being made of orange cull waste and sunn hemp, grass, wheat straw, etc., in preparing the store of manure. Notes are given on the fertilizer programme adopted since 1933 and its results. The problem of hard fruit or fruit containing gum pockets is considered. The exact causes of the condition remain unknown, but it is noticeable that so far the best results have been achieved by soil reclamation (see above). It is suggested that possibly the incidence of hard fruit may be associated with the gradual depletion of some rarer element in the soil, hence investigations, some already in progress, include the use of rarer elements in soil applications, tree sprayings and tree injections. V. *Report of plant pathologist*. Experiments on infection of oranges with the green mould, *Penicillium digitatum* Sacc. have been continued and several obscure points cleared up. Storage tests carried out included experiments on physiological or low-temperature breakdown, wastage due to various fungi, oiled wrappers, and loss of weight in storage. It is noted that on account of the serious injury developed by fruit wrapped in 15% oiled paper, the greater liability to certain types of wastage and the development of unpleasant flavour, this type of paper cannot be recommended for oranges. Special attention was paid to the following diseases:—die-back, gummosis, psoriasis or scaly bark. Finally a note is given of maturity standards and methods of sampling. Appendix I consists of a table of rainfall returns from the Mazoe Citrus Estate for the years 1919 to 1935. Appendix II shows graphically the mean weekly maximum and minimum temperatures, relative humidity and evaporation on the estate from 1929 to 1935.

787. [ADAMS, M. L.]

664.84 + 664.85

*Domestic preservation of fruit and vegetables.**Bull. Minist. Agric., Lond.*, 21, 1936, (4th Ed.), pp. 91, 1s.

This comprehensive and clearly illustrated bulletin was first issued in 1929 and has subsequently been revised from time to time in accordance with the results of the latest research work and to include new and improved recipes. The main contents are as follows:—The principles of preservation; fruit bottling, of apples, apricots, blackberries, cherries, currants, gooseberries, loganberries, mulberries, peaches, pears, plums, quinces, raspberries, rhubarb, strawberries, tomatoes and mixed fruit salad; fruit canning, with notes and a diagram on the operation of a hand can-closing machine; the principles and practices of jam-making from fresh-fruit, with a list of jam recipes; the preparation of fruit jellies, together with recipes; marmalade making from citrus fruits, with recipes; the preparation of fruit syrups; the preparation of candied, crystallized and glacé fruits; the preservation of vegetables by bottling and canning; a short account of the drying of fruits, vegetables and herbs; and, lastly, the preparation of chutneys and pickles.

788. [TAYLOR, H. V. AND JOHNSTONE, K. H.]

635.5

**Salad crops.***Bull. Minist. Agric., Lond., 55, 1936 (2nd Ed.),*\* pp. 81, bibl. in text, 1s. 6d.

Methods of cultivation, cutting and packing are described for the following salad crops:—Lettuce (cultivation in glasshouses, unheated houses, hot frames, cold frames, cloches, and out of doors in both summer and winter) endive, chicory, radish, mustard and cress, corn salad (*Valerianella olitoria* Moench.), dandelion and watercress. Brief descriptions are supplied of a number of varieties of each of these crops, and where these are French in origin the names used in that country are also noted. For the benefit of those who may have obtained the first edition of this bulletin, it may be pointed out that in the present edition surveys of salad production in the different counties of England have been condensed, while the advisory part has been enlarged and includes definite recommendations on methods of culture and varieties. The results of recent experimental work have also been incorporated.

789. MINISTRY OF AGRICULTURE, LONDON.

635.1/7 : 631.544

**Crop production in frames.***Bull. Minist. Agric., Lond., 65, 1937 (2nd Ed.),* pp. 74, bibl. 5., 1s. 6d.

This bulletin supersedes the bulletin of the same number (65) published in 1934 at 1s. under the title "The cultivation of vegetables in frames" and noted in *H.A.*, 1934, 4 : 234. The present issue is largely rewritten and contains 14 pages of additional matter. The construction and heating of frames is discussed, special attention being paid to electrical installations. Systems of production in heated and unheated frames are examined in detail and the treatment and rotations for the various crops are outlined. Following this is a chapter on those crops which do not fit into a definite rotation, such as melons, cucumbers and dwarf beans. Small protectors which form useful accessories to frames are mentioned, these include bell and continuous cloches, round zinc rims and collapsible sun boxes. A brief description is given of frame culture methods in Holland, France and U.S.A. There are appendices dealing with imports of vegetables and import duties. The historical introduction describing the primitive attempts of the early gardener to shelter his seedlings and tracing the gradual evolution of the market garden in England, particularly in regard to the appliances used, adds much to the interest of the work. The policy of the attractive and individual cover now adopted for these bulletins is to be commended.

790. MINISTRY OF AGRICULTURE, LONDON.

634.11-1.564.4

**Apple packing.***Bull. Minist. Agric., Lond., 84, 1936 (2nd Ed.),* pp. 29, 1s. 3d.

The contents of the first edition of this comprehensive bulletin have already been noted in *H.A.*, 1934, 4 : 693. In the second edition the text appears to remain unaltered, and the only changes concern certain of the photographs, appendices 1 and 2 which have been rearranged, and the addition of two further appendices dealing with National Mark apple labels and wraps and the specification of standard containers.

791. [TAYLOR, H. V. AND JOHNSTONE, K. H.]

635.939.98

**Chrysanthemums.***Bull. Minist. Agric., Lond., 92, 1936,* pp. 61, bibl. in text, 2s.

This bulletin has been prepared to assist growers interested in the production of chrysanthemum flowers for market. The following are the principal contents:—(1) Trade aspects, imports and prices, (2) Chrysanthemums as a commercial crop, site, soil, climate and type of glasshouse. (3) The chrysanthemum plant, with descriptions of flower characteristics, the technique of

\* First edition 1932.

hybridization, seed gathering and the care of seedlings, and a note on bud sports. (4) Classification and choice of varieties. (5) Lists of varieties, grouped as double and single, subdivided according to their season of flowering, with notes on colour, type and treatment. (6) Propagation and plant raising. (7) Cultivation of early-flowering chrysanthemums. (8) Cultivation of chrysanthemums flowering under glass. (9) Cultivation for sale as pot plants. (10) Cultivation for exhibition. (11) Timing the crop of flowers for the desired season by means of stopping, and "securing" the buds. (12) Cutting and preparation for market. (13) A survey of the cultivation of chrysanthemums in the following areas of England and Wales:—London and the south, midlands and west, Wales, east and north. (14) A short account of the cultivation of chrysanthemums in the U.S.

792. TAYLOR, H. V. AND JOHNSTONE, K. H. 635.9  
**Commercial flower production. Part I. Spring flowers and flowers grown under glass.**

*Bull. Minist. Agric., Lond.*, 96, 1936, pp. 77, bibl. in text, 2s. 6d.

This bulletin has been prepared for the use of commercial growers, and deals with early outdoor spring flowers and flowers that are grown mainly under glass. A further bulletin, now in course of preparation, will deal with summer flowers, mainly of the herbaceous type, pot plants, bedding plants and foliage plants. The cultivation of the following plants, together with recommendations as to manuring, disease and pest control, cutting, marketing and varieties, is described here:—Anemone, anthurium, arum lily, azalea (cut flowers only; pot plant cultivation will be dealt with in the second bulletin), camellia, carnation, Christmas rose (*Helleborus niger* var. *altifolius*), deutzia, doronicum, *Echeveria retusa*, eucharis, *Euphorbia fulgens*, forsythia, freesia, gardenia, *Gerbera Jamesoni*, gladiolus, hyacinth, irises, ixia, *Lapageria alba*, *Leucocoryne ixioides odorata*, lilac, lilies, lily of the valley, marguerite (*Chrysanthemum frutescens*), marigold (*Calendula officinalis*), mimosa, myosotis, narcissus, nerine, orchis, poinsettia (*Euphorbia pulcherrima*), polyanthus, primrose and cowslip, prunus, *Pyrus japonica*, ranunculus, rose, snowdrop, spirea, star of Bethlehem (*Allium neapolitanum grandiflorum*), *Stephanotis floribunda*, stock, sweet pea, trollius, tulip, *Viburnum Opulus sterile*, violet, wallflower and wood hyacinth (*Scilla campanulata*).

793. FOX WILSON, G. 632.6/7 : 635.9  
**Pests of ornamental garden plants.**

*Bull. Minist. Agric., Lond.*, 97, 1937, pp. 128, 3s. 6d.

The book forms one of the series of bulletins now in course of publication by the Ministry of Agriculture. In the brief foreword it is pointed out that because of the great variety of plants grown in private gardens the range of pests is likely also to be greater, and it is emphasized that it is the duty of the owners of gardens however small to control such pests, if only to prevent their spread to the commercial plantations of the neighbourhood. The bulletin falls into well defined sections, the first of which deals with control. Here cultural, mechanical, chemical, physical and biological methods are in turn discussed. This is followed on the mechanical side by rules for spraying and for glasshouse fumigation and spraying appliances and dusting machines are described. In the next section the more ubiquitous pests of the garden are dealt with, slugs, snails, woodlice, millipedes, aphides and so on. In the third section the garden is treated piecemeal and the pests of lawns, rose garden, herbaceous border and rock garden are discussed. Mr. Fox Wilson is undoubtedly amply qualified to produce a bulletin of this nature and he is to be congratulated on the maintenance of a simple form throughout, a boon to the amateur gardener for whose benefit the bulletin is mainly written. It is a pity that the bulletin at first sight seems to resemble nothing so much as a collection of the Ministry's leaflets in a superior binding, since the originality of the author is thereby somewhat discounted. With the exception of what must be to the layman an entirely incomprehensible diagram of the mouth parts of a beetle, the illustrations, if occasionally hackneyed, are excellent. The gardener, whether

professional or amateur, the student and even the expert biologist are fortunate in having such a comprehensive work presented to them at so moderate a price and it should be found on the bookshelves of all those interested in this aspect of pest control. A.M.M.

794. BARKER, B. T. P.

663.3

**Cider apple production.***Bull. Minist. Agric., Lond., 104, 1937, pp. 75, 1s. 6d.*

The whole of modern practice and much of the theory of cider apple production will be found in these pages and the name of the author is a guarantee that the work has been efficiently done. A note of the chapter headings will adequately indicate the contents. The cider industry in the British Isles—Cider apples: characteristics and varieties.—Special features of a cider orchard.—Perry pear orchards.—Orchard establishment and after care.—Renovation of existing orchards.—Disease and pest control.—Harvesting and storage of apples for vintage purposes.—Economics of cider fruit culture. An appendix contains a table of varieties showing name and vintage group, principal centres of production, orchard tree characters, seasons of blossoming, harvesting and milling, and vintage qualities of juice.

795. STANILAND, L. N. AND BARKER, D. R.

635.944-2.7

**The efficiency of baths used for the hot-water treatment of narcissus bulbs.***Bull. Minist. Agric., Lond., 105, 1937, pp. 29, bibl. 5.*

The authors give a detailed and illustrated account of the work done in recent years in this country towards the perfection of hot water treatment of narcissus bulbs for the control of eel-worm *Anguillulina dipsaci*. It should be of the greatest value to growers. Among the recommendations made are the following: (1) *Thermometer*. This must be accurate or the exact extent of its inaccuracy allowed for. It must be quick acting. Its ideal position is actually inside the bulb containers. Experiments are in progress to determine the most convenient form of bi-metallic thermometer. (2) *Bath*. Circular are greatly preferable to square or rectangular baths. They should be heat lagged with asbestos cement, felt or other material. (3) *Heating*. Electricity is preferable but is only economic for very small baths. Oil entails the concentration of heat within a small area and is, therefore, not entirely satisfactory. Gas can be so arranged as to be satisfactory. Steam, both high and low pressure, has advantages, provided precautions are taken. (4) *Containers*. Rigid containers are much preferable to sacks. Containers made from wooden battens and lined with  $\frac{1}{2}$  in. mesh galvanized wire netting are suitable. The form should be such that it can be loaded in several tiers. (5) *Temperatures*. An initial temperature of 115° F. prior to the loading of the bulbs is suitable. A warning is uttered that common sense is essential in carrying out all of these recommendations. In an appendix a diagram is given showing how to construct one of the containers mentioned above.

796. WALLACE, T.

631.8 : 634.1/7

**Manuring of fruit crops.***Bull. Minist. Agric., Lond., 107, 1937, pp. 47, 1s. 3d.*

This publication summarizes the results of recent manurial experiments on many classes of fruit at Long Ashton, East Malling, and elsewhere, including those in the United States likely to be of value in this country. The practical field problems of manuring are discussed such as rootstock effect, age of plants, the use of various fertilizers, manuring in relation to systems of fruit culture, grass effect, method and time of application and many others. Advice is given on the manuring of particular fruit crops, all the usual hard and soft fruits being dealt with separately though briefly. The bulletin should be of considerable value, compressing as it does into small compass, though in a most legible type, both the results of modern research and suggestions for their profitable application to commercial horticulture.

797. FRUIT JUICE CONGRESS. 663.813

*Preliminary report of 2nd international congress for the utilization of unfermented fruit juices.\**

Issued by the Secretariat of the Congress, Berlin N.W.40, Schlieffenufer 21, 1937, pp. 64, R.M.2.

Subjects dealt with and here summarized include the following:—Fruit culture and utilization of unfermented fruit juices ; significance of the utilization of unfermented fruit juices for human nutrition ; fruit and liquid in the treatment of disease ; legislation on unfermented fruit juices ; control of quality ; standards for the raw product ; pasteurization ; cold sterilization ; cellerage of juice ; transportation of juice ; role of pectic substances in treatment of juice ; recent experience on concentrated fruit and grape juice ; unfermented fruit juice in U.S.A. A full report is promised for the end of the year and should be obtainable from the Secretariat at a cost, it is understood, of R.M. 8-9. The report will be in German and possibly in French.

\* Held at Berlin 2-5 August, 1937.

